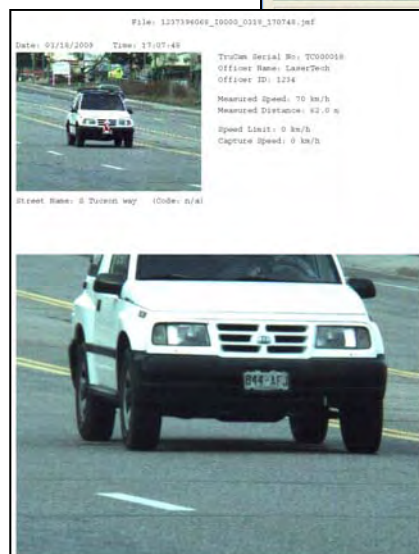
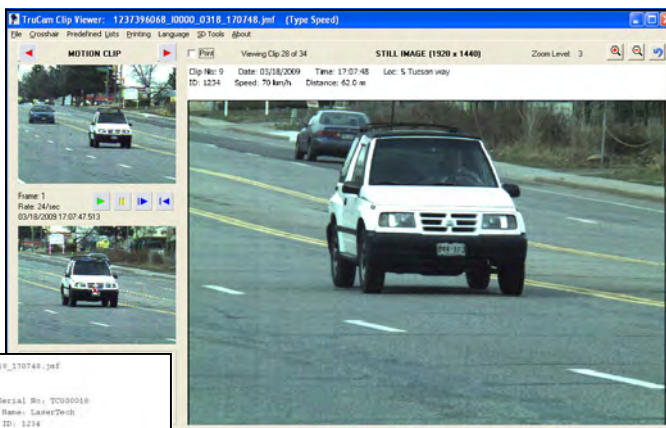


Laser Technology, Inc.

TruCAM User's Manual

All-in-one Digital Video Camera/Laser Speed and Ranging Device
Second Edition



 **LASER^{TECH} TECHNOLOGY**
Measurably Superior™

LTI TruCAM User's Manual
1st Edition
Part Number 0144823

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This product is covered by pending patent applications and the following issued patents: 5,359,404
5,521,696
5,617,199
5,715,045

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LTI TruCAM™ User's Manual 2nd Edition - Table of Contents

Section #1 - Introduction to the TruCAM	5
Unpacking Your TruCAM	5
Important Safety and Product Information	5
Views of the TruCAM	7
Quick Start	7
Section #2 - TruCAM Components	10
Power Supply	10
Charging the Battery Pack	10
Inserting the Battery Pack into the Handle	11
Removing the Battery Pack from the Handle	11
Understanding the Battery Voltage Icon	12
Laser Sensors	12
Camera	12
Sighting Scope	13
Adjusting the Aiming Reticle's Intensity	13
Secure Digital (SD) Card	13
USB Port	14
Real Time Clock	15
GPS Receiver	15
Serial Port	15
Jam Detect	16
LCD Touch Screen	16
Icons	16
Toolbar Buttons and Soft Keys	16
On-screen Keypad	17
LCD Backlight	17
TruCAM Image Viewer	17
Section #3 - TruCAM System and Information Screens	18
Powering ON the TruCAM	18
Powering OFF the TruCAM	18
System Setup Screen	19
System Options Screen	22
Device Information Screen	24
Device Parameters Screen	25
Section #4 - Roadside Laser/Camera Setup	28
Choosing a Roadside Location	28
Line of Sight	28
The Cosine Effect	28
Adjusting Camera Settings	30
Depth of Field	30
Iris	30
Automatic Gain Control	30
Camera Lens Focus Distance	31
Shutter Speed	31
White Balance & AGC Threshold	32
Attaching / Removing the Shoulder Stock	32
Attaching / Removing the Sun Shade	33

Section #5 - TruCAM Capture Modes	34
During the Capture Session	34
Speed Mode	35
Weather Mode	36
Auto Mode	36
Choosing a Location	36
Manned Mode	36
Unmanned Mode	36
Auto Mode Speed Measurements	37
Rear Plate Mode	37
Video Only Mode	37
Distance between Cars (DBC)	38
Selecting a Location	38
Roadside Offset	38
Taking the DBC Measurement	39
DBC Measurement Requirements	40
Dual Speed (Truck) Mode	41
Vehicle Classification	42
Dual Speed Measurements	42
Section #6 - Playback Mode	43
Displaying the Folders Stored on the SD Card	43
Loading the Motion Clip / Still Image File	44
Exiting Playback Mode	44
Section #7 - Instrument Tests & Confidence Checks	45
Self Test	45
HUD Integrity Test	45
Scope Alignment Test	45
Camera Alignment Test	46
Instrument Confidence Checks	46
Fixed Distance Zero Velocity Test	47
Delta Distance Test	48
Section #8 - Care and Maintenance	49
Operating Temperature	49
Moisture and Dust Protection	49
Shock Protection	49
Transporting	49
Cleaning and Storage	49
Caring for the Scope	49
Caring for the LCD Touch Screen	50
Realigning the LCD Touch Screen	50
Restoring Factory Default Settings	50
Section #9 - TruCAM Image Viewer	52
Installing the TruCAM Image Viewer Software	52
Starting the TruCAM Image Viewer Program	52
Using the Menu Bar	53
Transferring the *.jmf Files from the SD Card to the Office PC	55
Browsing the *.jmf Files	55
Playing a Motion Clip	57
Managing Predefined Lists	57
Operator Names List	58
Locations List	59
Selecting Languages	60
TruCAM Languages	60
TruCAM Image Viewer Languages	60

Section #10 - Troubleshooting Tips	61
Section #11 - Serial Data Interface	65
Data Format	65
Format Parameters	65
Download Instructions	65
Requests	65
Firmware Version ID Request	65
Serial Number Request	65
Initiate Measurement Request	66
Stop Measurement Request	66
Print Requests	66
Speed / Range / Date / Time Data Message Format	66
Error Messages	66
External Device Commands	67
Section #12 - Additional Information	68
Error Conditions	68
Error Messages	68
RFI Considerations	68
Sounds from the TruCAM	69
Icons that Appear at the Top of the TruCAM LCD Touch Screen	69
TruCAM Tool Bar Buttons	71
Glossary	72
World Time Zones	73
Section #13 - Specifications	74
Performance	74
Physical Construction	75
Hardware	75
Power	76
Software	76
Index	77

Notes:

Section #1 - Introduction to the TruCAM

Congratulations on the purchase of your TruCAM from Laser Technology, Inc. (LTI). The TruCAM is an all-in-one digital video camera/ laser speed and ranging device. The TruCAM not only measures speed, it can calculate the traveling time and distance between two following vehicles and produces full action video and still image evidence, for both speeding and tailgating violations.

- Standard Capture Modes: Speed Mode, Auto Mode (Manned or Unmanned), Rear Plate Mode and Video Only Mode.
- Motion clip and still image capture.
- Linux operating system with custom device drivers.
- High-Speed USB 2.0 connection.
- Built-in 20 channel Global Positioning System (GPS) receiver with Satellite-Based Augmentation System (SBAS).
- Long battery life.

Unpacking Your TruCAM

When you receive your TruCAM, check to make sure that you received everything that you ordered, and that it all arrived undamaged.

TruCAM Basic Package

- ☐ TruCAM Instrument
- ☐ SD Memory Card
- ☐ SD Card to USB Reader
- ☐ Battery Pack (2)
- ☐ Battery Charger, 110/200 v ac
- ☐ Sun Shade
- ☐ Stylus (3)
- ☐ Shoulder Rest
- ☐ TruCAM Image Viewer Software CD
- ☐ Carrying Case
- ☐ User's Manual
- ☐ LTI Limited Warranty

Optional Features

- ☐ Distance between Cars (DBC)
- ☐ Dual Speed

Available Accessories

- ☐ 3.5 X Magnifier
- ☐ Serial Cable (6-pin to DB9)
- ☐ Monopod
- ☐ Tripod
- ☐ TruSpeed/TruCAM Yoke (includes adapter for monopod/tripod mounting)
- ☐ 12V Automobile Charger

Important Safety and Product Information

The symbols below are used to distinguish between vital operating instructions and helpful information.



Vital operating instructions.



Helpful information.



WARNING

Never attempt to view the sun through the scope.

Looking at sun through the scope may permanently damage your eyes.

Misusing the battery may cause the battery to get hot, rupture or ignite and cause serious injury.

Be sure to follow the safety rules listed below:

- Do not place the battery in fire or heat the battery.
- Do not install the battery backwards so the polarity is reversed.
- Do not connect the positive terminal and the negative terminal of the battery to each other with any metal object (such as wire).
- Do not carry or store the battery with hair pins, necklaces or other metal objects.
- Do not pierce the battery with nails, strike the battery with a hammer, step on the battery or otherwise subject it to strong impacts or shocks.
- Do not solder directly onto the battery.
- Do not expose the battery to water, salt water or allow the battery to get wet.

Do not disassemble or modify the battery.

The battery contains safety and protection devices which, if damaged, may cause the battery to generate heat, rupture or ignite.

Do not place the battery or near fires, stoves or other high-temperature locations.

Do not set or store TruCam lithium ion batteries in direct sunshine. When storing batteries inside cars in hot weather be sure to keep them shaded and out of direct sun. Direct sun or extreme hot temperatures may cause the battery to heat up, rupture or ignite. Using the battery in this manner may also result in a loss of performance and a shortened life expectancy.

Do not discharge the battery using any device except the TruCAM.

Using the battery in a device other than the TruCAM may damage the performance of the battery or reduce its life expectancy, and if the device causes abnormal current flow, it may cause the battery to become hot, rupture or ignite and cause serious injury.



CAUTION

Avoid staring directly at the laser beam for prolonged periods.

The TruCAM is designed to meet FDA eye safety requirements and is classified as eye-safe to Class 1 limits, which means that virtually no hazard is associated with directly viewing the laser output under normal conditions. As with any laser device, reasonable precautions should be taken in its operation. It is recommended that you avoid staring into the transmit lens while firing the laser. The use of optical instruments with this product may increase eye hazard.

Never point the instrument directly at the sun.

Exposing the lens system to direct sunlight, even for a brief period, may permanently damage the laser transmitter.

Do not operate the instrument in extreme temperatures.

TruCAM components are rated for a temperature range of -10° C to +60° C (14° F to 140° F).

Do not operate the instrument in temperatures outside that range.

Li-ion battery cells can become unstable (potentially dangerous) at low and high temperatures.

- Charging Temperature Range: 0° C to +45° C (+32° F to +113° F).
- Storage Temperature Range: -20° C to +60° C (-4° F to +140° F).

Immediately discontinue use of the battery if, while using, charging or storing the battery, the battery unit emits an unusual smell, feels hot, changes color, changes shape or appears abnormal in any other way.

Contact LTI or your local Authorized LTI Dealer if any of these problems are observed.

Do not place the battery in microwave ovens, high-pressure containers or on induction cookware.

In the event that the battery leaks and the fluid gets into one's eye, do not rub the eye. Rinse well with water and immediately seek medical care.

If left untreated the battery fluid could cause damage to the eye.

Views of the TruCAM

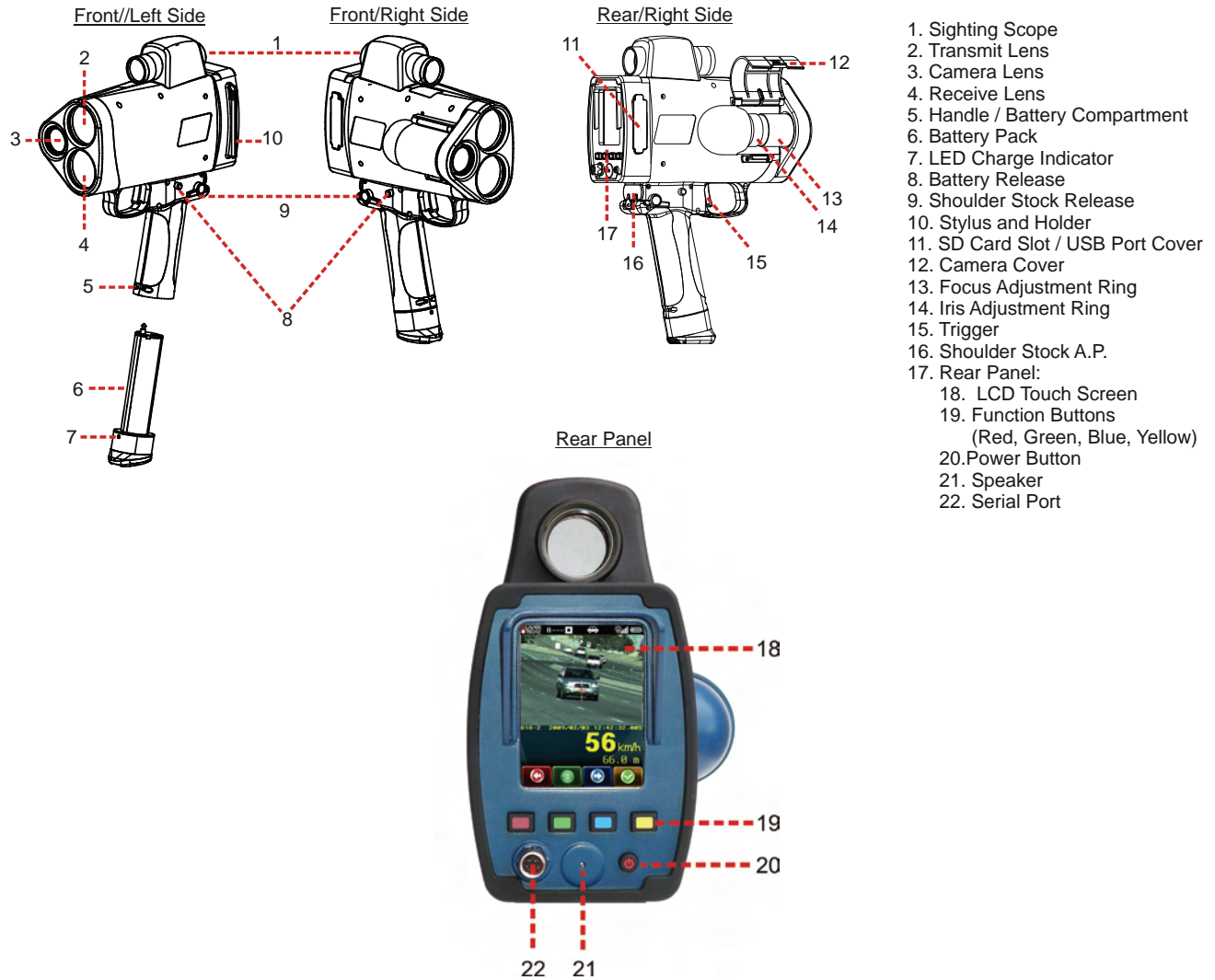


Figure #1

Quick Start

This section demonstrates the basic speed measurement and still image / motion clip capture and the playback process.

Preparation:







1. If necessary, charge the Battery Pack (page 10).
2. If necessary, insert the Battery Pack into the Handle (page 11).
3. If necessary, insert the SD Card into the SD Card Slot (page 13).

Speed Measurement and Still Image / Motion Clip Capture:

Selecting a Target:

1. Press and release the Power button. Initially, the TruCAM Splash screen will be displayed on the LCD Touch Screen. Then the Self Test Results Screen will be displayed briefly before the System Setup Screen is displayed.
2. Locate a target with defined edges that is approximately 70 meters (229 feet) away. A street sign is ideal. The specific distance is not critical, but the camera's optimum targeting distance is 70 meters (229 feet).

Focusing the Camera:

1. Pull and release the TRIGGER to start the live video function. Briefly the screen should look similar to Figure #2. Then the live video will appear in the upper half of the screen.
2. Open the Camera Cover to allow access to the Focus Adjustment Ring and the Iris Adjustment Ring.
3. Aim the TruCAM to the target selected in step #1 and adjust the iris for the best amount of light entering the camera.
4. Tap  or press the  soft key to display the other options on the Caption Session Toolbar.
5. Tap  or press the  soft key to increase the screen magnification. This will make it easier to set the focus. Repeat this step as needed to return the screen image to normal display before taking a speed measurement.
6. If necessary, tap  or press the  soft key to adjust the shutter speed.

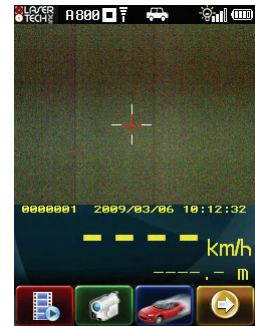




























Figure #2

Taking a Sample Speed Measurement:

1. If Speed Mode is not active, tap  or press the  soft key.
2. Use the sighting scope and aiming reticle to aim the TruCAM to the selected target.
3. To fire the laser, pull and hold the TRIGGER. The laser will fire after a short delay.
4. Continue to press the TRIGGER and keep the instrument sighted on the target:
 - A low-pitched growl means that the instrument is attempting to lock onto the target.
 - 1 Low-Pitched and 2 High-Pitched Beeps mean that a measurement error occurred. An error message will be displayed.
 - A high-pitched single beep means that a speed was captured. The measured speed will be displayed on the LCD screen and will be projected in the scope, just below the aiming reticle.
5. Release the TRIGGER. The vehicle image, measured speed and distance will be displayed.
 - If you did not capture a speed, an error message will be displayed. Repeat the above steps.

Motion Clip Playback:

1. Tap  or press the  soft key. A preview of the still image is displayed. It should look similar to Figure #3.
2. Tap  or press the  soft key to load the motion clip/still image file.

Toolbar Button	Alternative Soft Key	Function
		Tap to load the motion clip/still image.
		Tap to advance one frame.
		Tap to play the motion clip. As the motion clip is being played, the frame number will be updated.
		This button is displayed while the motion clip is being played back. Tap to stop the playback.
		Tap to reload the motion clip.
		Tap to change the brightness of the LCD Backlight.
		Tap to load the still image.
		Tap to enlarge detail of the displayed image.
		Tap to restore normal display.
		Tap to return to Playback Mode.

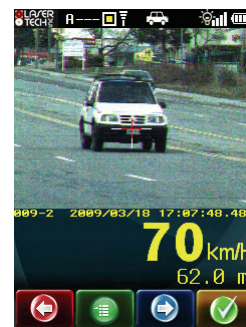


Figure #3

Exiting Playback Mode:

When you are ready to exit Playback Mode:

- To power OFF the TruCAM, press and hold the Power button.
- To display the System Setup Screen, press and release the Power button.
- To return to Capture Mode, pull the TRIGGER.

Section #2 - TruCAM Components

Power Supply

A Lithium-ion Polymer rechargeable Battery Pack powers the TruCAM. The Battery Pack is located in the TruCAM's handle. It is protected from short circuit and overcharge, and will provide 9 to 15 hours of cordless operation.

Charging the Battery Pack



WARNING

Be sure to follow the instructions below while charging the battery.

Failure to do so may cause the battery to become hot, rupture or ignite and cause serious injury.

- When charging the battery, use the charging cable that shipped with your TruCAM.
- Do not attach the battery to a power supply plug or directly to a car's cigarette lighter.
- Do not place the battery in or near fire, or into direct sunlight. When the battery becomes hot, the built-in safety equipment is activated, preventing the battery from charging further. Heating the battery can destroy the safety equipment and cause additional heating, breaking or ignition of the battery.

Do not continue charging the battery if it does not recharge within the specified charging time.

Doing so may cause the battery to become hot, rupture or ignite.



CAUTION

Li-ion battery cells can become unstable (potentially dangerous) at low and high temperatures.

Charging Temperature Range: 0° C to 45° C (32° F to 113° F). Charging the battery outside of this range may cause the battery to become hot or to break. Charging the battery outside of this temperature range may also harm the performance of the battery or reduce the battery's life expectancy.

Do not leave the battery unattended while charging.

Immediately unplug the charging cable if during the charging process, the battery emits an unusual smell, feels hot, changes color, changes shape or appears abnormal in any other way. Contact LTI or your local Authorized LTI Dealer if any of these problems are observed.

To avoid damaging your TruCAM or the Charging Cable, check to be sure all connectors are properly aligned before connecting them.

If battery voltage is below normal operation level (page 12), please power OFF the TruCAM and recharge the Battery Pack as soon as possible. The Charging Cable works in a standard electrical outlet. You can also charge your TruCAM in your automobile with an optional Automobile Charger that works in your vehicle's electrical cigarette lighter or a 12-volt power outlet.

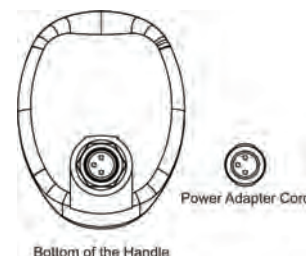


Figure #4

1. Plug the appropriate end of the Charging Cable into the bottom of the battery pack as shown in Figure #4. Before applying any force, ensure that the pins in the bottom of the handle are aligned with the Charging Cable.
2. Plug the other end of the Charging Cable into a power outlet. The color of the LED Charge indicator (see Figure #5) on the Handle indicates battery charge status:
 - Orange = charging. Charging time is about 4.5 hours or less.
 - If the LED is not illuminated, refer to the PreCharging Routine (see next page).
 - Green = fully charged.
 - Yellow blinking = malfunction. Contact LTI Service for repair. See inside front cover for LTI contact information.
3. When finished charging, disconnect the Charging Cable from the power outlet, and then disconnect from the TruCAM by gripping and pulling the green connector plug.



Figure #5

- ❗ If the battery charge is very low, the LED Charge Indicator may not illuminate when you plug in the Charging Cable. Li-ion battery cells must have a nominal voltage of approximately 2 volts within them before a large amount of current can be applied. If the cells are below 2 volts, a high current could be dangerous. Therefore, if the cell voltage is less than the nominal 2 volts, the internal charging circuit supplies a very small amount of current to slowly bring the battery charge up to a nominal voltage.

Precharging Routine

If the LED Charge Indicator does not illuminate when the Charging Cable is plugged in:

1. Leave it plugged in for at least one hour to trickle charge the Battery Pack.
If after one hour there is a good level of voltage, charging can occur.
2. Disconnect both ends of the Charging Cable.
3. Reconnect both ends of the Charging Cable.
 - If enough voltage is present, charging will start and the LED will be orange.
 - If the LED Charge indicator still does not illuminate, contact LTI or an LTI authorized service center for assistance. See the inside front cover for LTI contact information.
4. Refer to the Charging the Battery Pack Instructions (previous page).

Inserting the Battery Pack into the Handle

The Battery Compartment is designed so the Battery Pack only fits one way.

1. Align the notched edges of the Battery Pack with those of the Battery Compartment.
2. Slide the pack halfway into the compartment.
3. Using the palm of your hand and smooth, firm motion slide the Battery Pack up until it locks into place. The required force is similar to the force required to insert a magazine into a firearm.



Figure #6

Removing the Battery Pack from the Handle

1. Hold the TruCAM with one hand and hold the bottom of the Handle with your other hand.
2. Press the Battery Release: simultaneously press the black buttons on both sides of the TruCAM, just behind the TRIGGER.
3. Slide the Battery Pack out of the Battery Compartment.

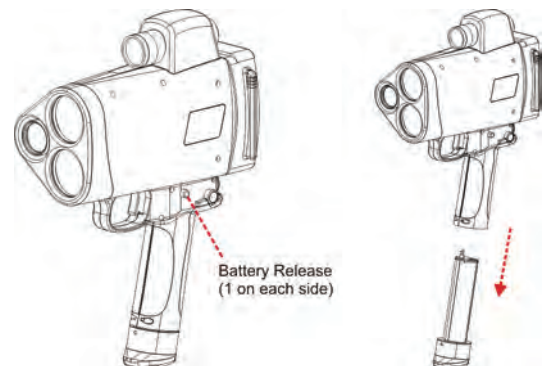







Figure #7

Understanding the Battery Voltage Icon

The TruCAM continuously monitors its power source. LTI has defined an acceptable battery voltage range to ensure that the instrument has sufficient battery voltage to guarantee correct operation. The battery icon is located in the upper right corner of the LCD Touch Screen.

Appearance of the Battery Icon	Explanation
	4 segments lit = 75% - 100% estimated battery life.
	3 segments lit = 50% - 75% estimated battery life.
	2 segments lit = 25% - 50% estimated battery life.
	1 segment lit = 5% - 25% estimated battery life.
	0 segments lit and red 'X' = 5% or less estimated battery life. You need to replace or recharge the battery pack as soon as possible.

Laser Sensors

The TruCAM has three lenses on the front panel. The smaller lens is the Camera Lens. The top lens transmits the infrared laser signals. The bottom lens receives the signals back from the target and feeds signal information to the internal circuitry.

The internal circuitry consists of a laser range sensor and timing, analysis, computation, and display circuits. The TruCAM determines distance through its laser range sensor, by measuring the time of flight of short pulses of infrared light. The TruCAM has a broad spectrum of sensitivity and can work with both reflective and non-reflective targets. The maximum measurement distance varies with target and environmental conditions. The absolute maximum is about 1,200 meters (4,000 feet).

- ❗ The laser diode emits light in the infrared portion of the electromagnetic spectrum. Infrared light is invisible to the human eye and can not be a distraction to drivers or operators.

Camera

The camera captures single frames as well as continuous motion clips. Specifications include CMOS imaging technology, 3-megapixel resolution, and 12.7 mm (½-inch) optical format.

- ❗ Adjustable Settings:
 - Automatic Gain Control (page 30)
 - Camera Lens Focus Distance (page 31)
 - Iris (page 30)
 - Shutter Speed (page 31)
 - White Balance (page 32)

To open the Camera Cover:

1. Press the tab on the underside of the camera. There is a hinge that secures the cover to the TruCAM.

To close the Lens Cover:

1. Push the cover down to close it.
2. Secure the tab on the underside of the cover in the slot.

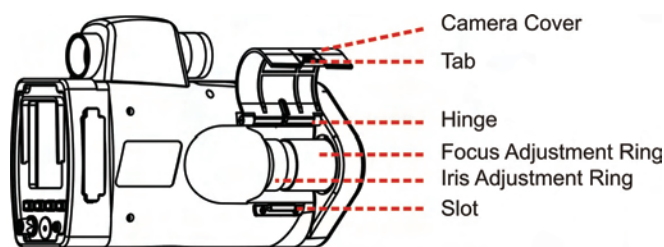


Figure #8

Sighting Scope

A single-power sighting scope is mounted on top of the TruCAM.

- The polarizing light filter is adjustable to optimize viewing contrast. Figure #9 shows the polarizing light filter's adjustment ring.

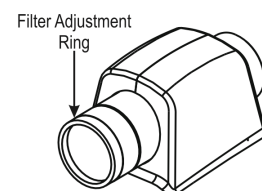


Figure #9

- The in-scope aiming reticle helps you aim accurately to the target. Figure #10 shows the reticle. This reticle represents the approximate size of the laser beam on the target.
- In-scope speed measurement display.

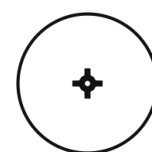


Figure #10

Adjusting the Aiming Reticle's Intensity

You can vary the intensity of the aiming reticle to account for different lighting conditions. The in-scope aiming reticle has eight intensity settings from DIM (01) to BRIGHT (08).





- Tap  or press the  soft key. The display should look similar to Figure #11. The factory default setting is "br06"
- Repeat tapping  or pressing the  soft key until the desired setting is achieved. It's easy to get the desired setting if you look through the scope while making the adjustment.
 - Each time you press the button, the "brxx" value increases by 1.
 - If you press the button while "br08" is displayed, you will see "br01" next.
- Pull the TRIGGER to accept the current setting.



Figure #11

- ⓘ Powering OFF the instrument does not change this setting. The next time the instrument is powered ON, the setting will be the same.
- Restoring the Factory Default Settings (page 27), resets this value to br06.

Secure Digital (SD) Card



CAUTION

- Do not remove the SD Card when the TruCAM is powered ON. To do so could damage the SD Card.
- If necessary, the TruCAM will attempt to recover (repair) damaged file system on the SD Card (page 23).

All data is stored on the removable SD card. Each file contains the motion clip, still image, and all associated data. Each file is encrypted using the AES-128* data encryption standard. The number of files that can be saved on each SD card depends upon the SD card size, the image size selected and the length of video captured for each file. For a 4 GB SD card, the average is approximately 2,000 files stored.

The SD Card Slot is located under the cover that is part of the rear rubber bumper and is on the same side as the Camera. The Cover opens from the top down. The SD Card must be installed before power ON. Refer to Figure #12 when inserting the SD Card. Do not insert the card upside down; make sure that the label is up. The SD card is asymmetrically shaped in order not to be inserted upside down.

- ⓘ For information about SD Card format requirements see page 62.

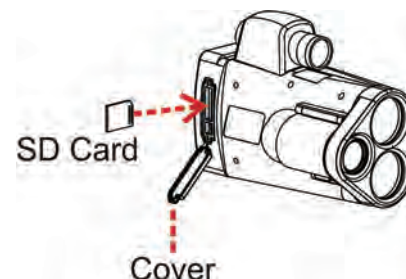
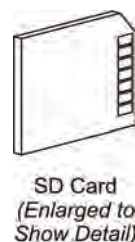


Figure #12

The SD Card includes the TruCAM folder and two subfolders:

- film: motion clips Contains many folders. Folder names are 5 characters (MM_DD).
still images Where MM is the month and DD is the date. Example: 05_04 = May 4th.
Example motion clip/still image file name: 1228306087_D1000_1203_120807.jmf
- config: daily data System configuration data: operator name, operator ID, and non-critical data like LCD backlight level, HUD brightness, etc.

USB Port

The TruCAM's High-Speed USB 2.0 connection is located under the cover that is part of the rear rubber bumper and is on the same side as the Camera. See Figure #13. The Cover opens from the top down. The USB connection allows you to copy files from the TruCAM/SD Card to the Office PC. The TruCAM does not ship with a USB cable.

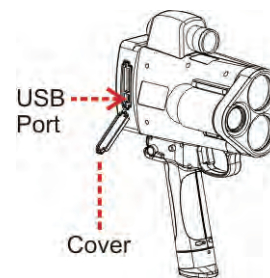


Figure #13

USB Cable requirements:

- High-Speed USB 2.0
- Length: 1-2 meters (3 - 6 feet)
- Ferrite core (see Figure #14)
- A High-Speed USB 2.0 cable used to transfer data from a digital camera or scanner to a PC should be compatible with the TruCAM.

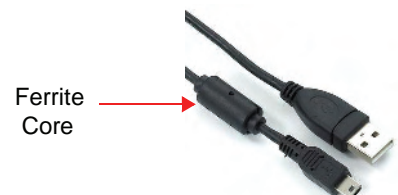


Figure #14

Copying Files from the TruCAM SD Card to the Office PC

1. Power ON the TruCAM.
2. Connect the appropriate end of the USB Cable to the TruCAM.
3. Connect the other end of the cable to the PC. The TruCAM will detect the USB connection. Figure #15 shows the screen that will be displayed.
4. On the Office PC, use My Computer or Microsoft Windows Explorer to navigate to the SD Card. The SD Card will appear as *Drive Letter: Removable Disk*. The drive letter varies and depends upon how your computer is setup.

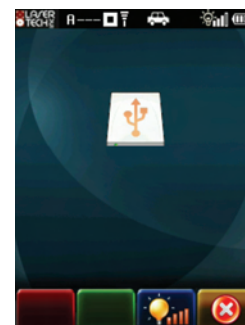


Figure #15


-  • The files in the directory displayed on the PC are Read Only. You can copy the files from the SD card onto your PC. You cannot delete files or write files to the TruCAM SD Card.
- Since you cannot change the contents of the SD card, the USB cable can be removed at any time without concern of lost files or corrupting the file structure on the SD card.
- The TruCAM will automatically power OFF 60 seconds after the USB cable is unplugged. In Figure #16 the TruCAM will power OFF in 50 seconds. The TruCAM will countdown the seconds until the unit powers OFF. The cable can be reconnected anytime during the countdown process.



Figure #16

Real Time Clock

The TruCAM's internal system clock is a Real Time Clock (RTC), and its accuracy is 20 parts per million (ppm) over the full operating temperature of -30° C to +60° C (-22° F to +140° F). ±10 minutes per year.

GPS Receiver


The Global Positioning System (GPS) is based on 24 satellites, orbiting 20,000 km above the Earth in 12-hour circular orbits. In order to make sure that they can be detected from anywhere on the Earth's surface, the satellites are divided into six groups of four. Each group is assigned a different path to follow. This creates six orbital planes which completely surround the Earth. These satellites send radio signals to Earth that contain information about the satellite. Using GPS ground-based receivers, these signals can be detected and used to determine the receivers' positions: latitude, longitude and height.

In the TruCAM, GPS is used to automatically set and synchronize the system time. You need only set the local time zone and day light savings information (page 20). The TruCAM is capable of receiving Satellite-Based Augmentation System (SBAS) differential corrections in both Wide-Area Augmentation System (WAAS) and European Geostationary Navigation Overlay Service (EGNOS).



Figure #17

i Although the GPS data is transmitted continuously, the following items need to be considered:

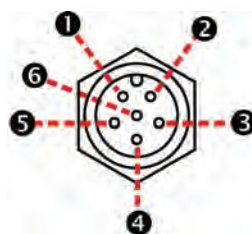
- The default GPS Interval is 60 seconds. The default setting is designed for battery life.
- You can change this value on the Device Parameters Screen (page 26).
 - A shorter interval will increase the GPS on-time, but will also reduce battery life.
 - A longer interval will decrease the GPS on-time and extend the battery life.
- *When GPS is locked in*, the  icon appears at the top of the LCD Touch Screen and the real time clock has been synchronized with the GPS.
- *When the GPS is not locked in*, the time is from the internal TruCAM real time clock.
- GPS receivers do not work well underground, inside buildings/tunnels, or if there is an obstruction to the TruCAM. Areas where there are tall buildings or dense strands of trees may also obstruct the signal.

Serial Port

The serial port is located in the lower left corner of the rear panel. It allows you to connect an external device to the TruCAM. Figure #18 shows the pin-out assignments for the TruCAM's serial port.

i The serial port provides:

- RS232 serial communication
- RS485 night time flash signal
- Auxiliary power supply for accessory items



- 1** Serial Out (TX)
- 2** 485, A (External Flash)
- 3** Serial In (RX)
- 4** Ground
- 5** 485, B (External Flash)
- 6** 4.6V External Power

Figure #18

Jam Detect



The TruCAM contains advanced circuitry and algorithms that allow the instrument to determine if a laser jammer is potentially being used. There are two possible situations:

- You are targeting a strong light source such as xenon headlights.
-or-
- A targeted vehicle is employing a laser jammer.

Regardless of the level of interference, you will never get an erroneous speed reading.

- At a low level of interference, a speed may be captured or an E03 error code may be displayed.
- At a high level of interference, an E07 error code will be displayed.

LCD Touch Screen

	CAUTION: To prevent damage to the Touch Screen, never use any device other than the stylus that comes with the TruCAM to tap on the LCD Touch Screen. If your stylus is lost or broken, please contact LTI to order a replacement stylus. See the inside front cover for LTI contact information.
	Some polarized sunglasses will block out the view of the LCD screen. This is related to the way light interacts with the polarized lenses and is not a malfunction of the LCD Touch Screen. In this situation, you may find it is beneficial to attach the Sun Shade (page 33) or adjust the LCD Backlight level (page 17).

The LCD Touch Screen is located on the rear panel of the TruCAM. The LCD Touch Screen is 7 cm (2.7 inch) QVGA color and sunlight readable. Your TruCAM comes with a stylus that you should use to tap on the screen. You can perform two basic actions using the stylus:

- Tap: Use the stylus to lightly touch the screen to select an item. Tapping is equivalent to clicking an item with the mouse on your computer.
- Double-tap to modify or open an option, item, etc.
- If the TruCAM does not respond properly to your taps, the LCD Touch Screen may need to be realigned. The Align Screen option is available on the Device Parameters Screen. See page 50 for information about realigning the touch screen.

Icons

The icons are the images that are displayed at the top of the LCD Touch Screen. The icons show such things as the battery voltage level, LCD Backlight Level, Capture Mode, zoom factor, shutter speed, etc. See page 69 for a list of the icons.

Toolbar Buttons and Soft Keys

The toolbar is located at the bottom of the LCD Touch Screen. The available toolbar buttons vary with each screen. Each screen contains 4 toolbar buttons. There are 4 colored soft keys on the TruCAM's rear panel, the colors correspond to the toolbar buttons. As an alternative to tapping a toolbar button, you can press the corresponding soft key. See page 71 for a list of the toolbar buttons.



Figure #19

On-screen Keypad

Whenever alpha-numeric data entry is required, the TruCAM displays a set of keypads. As Figure #20 shows, the keypad is automatically selected by the Language option (page 21). Use the stylus to tap the letters, numbers and symbols on the on-screen keypad to enter typed text directly onto the screen.

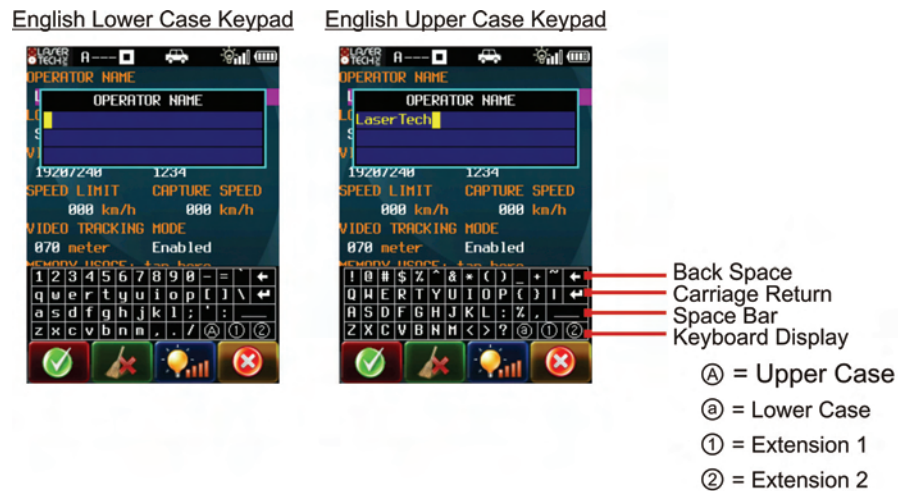


Figure #20

- Tap or press the soft key to save the current data and close the data entry message box. Figure #20 (right) shows Operator Name and the new data is "Laser Tech".
- Tap or press the soft key to jump to the beginning of the data entry field.
- Tap or press the soft key to adjust the intensity of the LCD backlight. See below.
- Tap or press the soft key to close the data entry message box without changing the current data. Figure #20 (left) shows Operator Name and the field is blank.

LCD Backlight

You can vary the intensity of the LCD Backlight to account for different lighting conditions. The LCD Backlight has five intensity settings. When the toolbar button is displayed, tap it or press the soft key to adjust the intensity of the backlight. Tap repeatedly until the desired level is achieved.

- 0 = dimmest
- 1
- 2
- 3 = default
- 4 = brightest

TruCAM Image Viewer

TruCAM Image Viewer is a software program that runs on a PC and allows you to view the motion clips and still images. It is covered in Section #9 (page 52).

Section #3 - TruCAM System and Information Screens

This section covers the screens that display system information and prepare the TruCAM for measuring speeds and capturing motion clips / still images.

Powering ON the TruCAM

1. Press the Power button or pull and release the TRIGGER. The TruCAM Splash Screen appears briefly, it should look like Figure #21. Next the instrument's microcontroller performs the Self Test.
 - *If all tests prove positive*, the Self Test Results Screen appears briefly, it should look like Figure #22. Next the System Setup Screen is displayed (page 19).
 - *If all tests do not prove positive*, the appropriate error code will appear. Figure #23 shows an example error message box.



Figure #21



Figure #22



Figure #23

i If the Self Test indicates an error message:

1. Press the Power button to power OFF the TruCAM.
2. Remove and re-insert the Battery Pack (page 11).
3. Power ON the TruCAM one more time to repeat the Self Test.
4. If the error repeats, power OFF the TruCAM. If the power source is not the problem, contact LTI for assistance. See the inside front cover for LTI contact information.

If you want to go directly to the Capture Mode:

1. Pull the TRIGGER to start the Capture Mode.
2. Pull the TRIGGER a second time to activate the aiming reticle.

Otherwise, see page 19 for information about the System Setup Screen.

Powering OFF the TruCAM

1. Press and hold the Power button for approximately 2 seconds. It will take approximately 10 seconds for the operating system to shut down.

i • You can press and release the Power button to cancel the displayed screen. This is useful when the



toolbar button is not displayed. Examples: Aligning the LCD Touch Screen or if the Capture Mode is active and you want to display the System Setup Screen.

- To help save its battery charge, the TruCAM has factory-defined power OFF intervals. The default intervals are listed below. You can change the power OFF intervals on the Device Parameters Screen (page 25).
 - Instrument: 10 minutes
 - LCD Backlight: 2 minutes
 - Camera: 1 minute
 - GPS Interval: 1 minute

System Setup Screen

When you power ON the TruCAM, the instrument will perform the Self Test (page 18). Upon successful completion of the Self Test, the System Setup Screen is the next screen displayed.



- Changes to the System Setup Screen are not saved until you tap or press the soft key. However, unsaved changes are valid until the TruCAM is powered OFF.
- If DBC is enabled, the System Setup Screen will include Roadside Offset option (page 38).
- If Dual Speed is enabled, the System Setup Screen will include 2 Speed Limits and 2 Capture Speeds (page 41).



Figure #24

Use the stylus to select the option that you want to change. You can either double-tap the field,

or tap the desired field, and then tap or press the soft key.

Once you have selected an option, you can tap or press the soft key to scroll to the next option.

- **OPERATOR NAME**: Your name. Use the stylus and on-screen keypad to enter the required information. 49 character maximum.
- **LOCATION**: Street name, city, etc. Use the stylus and on-screen keypad to enter the required information. 59 character maximum.
- **VIDEO MODE**: Using the stylus, tap the Video Mode field to display the next value. Value = Still Image Size / Motion Clip Size.

Video Mode Options

- ♦ 1920/240
- ♦ 1920/480
- ♦ 1440/240
- ♦ 1440/480

Still Image Sizes

- 1920 x 1440 pixels
- 1920 x 1440 pixels
- 1440 x 1080 pixels
- 1440 x 1080 pixels

Motion Clip Sizes

- 240 x 180 pixels
- 480 x 360 pixels
- 240 x 180 pixels
- 480 x 360 pixels



When selecting the Video Mode, you need to consider both image size and file size. Larger images sizes provide more detail, but smaller image sizes require less space for data storage.

- **OPERATOR ID**: Additional information such as officer number or rank. Use the stylus and on-screen keypad to enter the required information. 14 character maximum. Default = 23456.
- **SPEED LIMIT**: The posted speed limit for the location. Use the stylus and on-screen keypad to enter the required information.
 - ♦ km/h: 0 - 320
 - ♦ MPH: 0 - 200
- **CAPTURE SPEED**: The Capture Speed Limit is the capture threshold for an image. The TruCAM will only capture an image when the vehicle's measured speed is equal to or greater than the Capture Speed Limit. Use the stylus and on-screen keypad to enter the required information.
 - ♦ km/h: 0 - 320
 - ♦ MPH: 0 - 200
- **VIDEO TRACKING MODE**: When this mode is enabled, you can measure the speed of a distant target vehicle and store a motion clip. While continuing to pull the TRIGGER and keeping the aiming reticle aimed at the target vehicle's license plate. The still image of the vehicle is captured once the vehicle reaches the camera focus range.
 - ♦ The distance value is the camera focus distance where the still image capture will occur.
 - ♦ Use the stylus and on-screen keypad to enter the required value.
 - ♦ Range = 15 - 150 meters (50 - 500 feet)
 - ♦ Default value = 70 meters (229 feet)
 - ♦ Use the stylus to Enable or Disable this mode. When this option is disabled, the still image is captured when the speed is measured. Image quality may be poor if the target vehicle is not in the camera focus range.

- **MEMORY USAGE:** Use the stylus to tap the spot indicated on the screen ("tap here") to display memory usage. See Figure #25. As shown in the figure, a message box will be displayed briefly. In this example Free Space = 3267 MB and the 4GB SD Card is approximately 16% full. See page 75 for information about SD Card requirements.

- ① The number of files that can be saved on each SD Card depends upon the SD Card size, the image size selected, and the length of the video captured for each file. For a 4 GB SD Card, the average is approximately 2,000 files stored.



Figure #25

- **Date & Time:** [GPS] Current date and time. The date format can be changed on the Device Parameters Screen (page 25). Using Figure #25 as an example, the screen image was captured on Friday, December 5, 2008 at 15:28:39 PM.

When you receive your TruCAM, the date and time will not match your location. It is easy to set the clock, but it does require some knowledge about time zone and daylight savings (summer) time.

- ① You will need to know:

- How does your local time compare to Coordinated Universal Time (UTC)? Page 73 includes a map of World Time Zones.
- Does your location use daylight savings time? If yes, what are the start and end dates for daylight savings time?
- If you are not able to answer the above questions, Google "Coordinated Universal Time" or contact your Authorized LTI Dealer. You may also contact LTI for assistance. See inside front cover for LTI contact information.

To change the Date & Time:

1. Use the stylus to double-tap the current date and time. As Figure #26(A) shows, a message box will be displayed, prompting you to enter the required user password.
2. Use the stylus and on-screen keypad to enter the user password.



- ① • The default user password = admin
- To change the user password, see page 27.
- If you cannot remember current user password, contact LTI for assistance. See inside front cover for LTI contact information.



A message window will be displayed that includes the current setting. As an example, Figure #26(B) shows the information for Denver, CO USA.

- -07.00 = Denver is -07.00 offset from UTC
- 03:2 (MM:W) = For 2009, daylight savings time starts the 2nd Sunday in March (3rd month).
- 11:1 (MM:W) = For 2009, daylight savings time ends the first Sunday in November (11th month).

- ① • If your location does not use daylight savings time, just enter the offset from UTC. See Figure #26(C).
- In the Southern Hemisphere, the beginning month will be larger than the ending month, 8:2,4:2 for example. This example represents the 2nd week in August and the 2nd week in April.

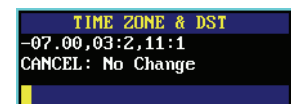
3. Use the stylus and on-screen keypad to enter the information for your location.

When done, tap  or press the  soft key:

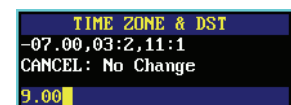
- If there are no errors, you will hear a good tone and the System Setup Screen will be displayed.
*****The change is not immediately displayed. The Date & Time is only updated when the GPS has a fix. In most cases you will have to be outside and cycle the TruCAM OFF/ON.**
- If there is an error, an error message will be displayed and it may look similar to Figure #26(D). Tap OK and try entering the information again.
- Tap  or press the  soft key to cancel without changing the date and time.



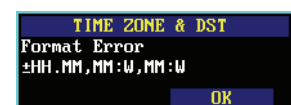
(A)



(B)













(C)



(D)

Figure #26

- **LANGUAGE:** English (default). Using the stylus, tap the Video Mode field to display the next language.
 - Languages are selected loaded via the TruCAM Viewer Program (page 60).
 - For more information about language availability, contact your authorized LTI Dealer.
- **Icons at top of the LCD Touch Screen**
See page 69 for information about the icons that appear at the top of the LCD Touch Screen.
- **Tool Bar Buttons at the Bottom of the LCD Touch Screen**





Toolbar Button	Alternative Soft Key	Function
		Tap to enter the Test Mode. The Scope Alignment Test (page 45) will be the first screen displayed.
		This button is displayed only after you select an option. Tap to scroll to the next option that appears on the screen.
		Tap to select the option that you want to change.
		Tap to change the brightness of the LCD Backlight (page 17).
		Tap to enter Playback Mode (page 43). The most recent image will be displayed.

System Options Screen





Figure #27

To display the System Options Screen:



From the System Setup Screen, tap  and then  or press the  soft key and then the  soft key.



- Changes are not saved until you tap the  or press the  soft key. However, unsaved changes are valid until the TruCAM is powered OFF.
- If your TruCAM includes the optional Dual Speed feature, the System Options Screen will include the TRUCK SPEED option (page 41).

Use the stylus to select the option that you want to change. You can either double-tap the field, or tap

the desired field, and then tap  or press the  soft key.

Once you have selected an option, you can tap  or press the  soft key to scroll to the next option.

- **MEASUREMENT UNITS:** This option is factory-set and appears as display only. Before the TruCAM ships from the factory, it is locked into one of three configurations:
 - ♦ Metric: km/h and meters
 - ♦ Imperial: MPH and feet
 - ♦ UK: MPH and meters
- **AUTO CAPTURE:** When Auto Mode is enabled, the laser fires continuously as it acquires targets. During this mode, still image capture is based on the Camera Lens Focus Distance (see below). Use the stylus to toggle between Manned Mode and Unmanned Mode.
 - ♦ **Manned:** Manned Mode means that there is an operator observing each measurement whom can go to court and testify if necessary. In this mode only a still image is produced. 1 to 2 measurements per second are possible (depends on image size selection).
 - ♦ **Unmanned:** In this mode, an operator is not present. The system takes a small video clip in addition to the still image. Due to the extra processing, only 1 measurement per 1 to 2 seconds is possible (depends on image size selection).
- **CAMERA LENS FOCUS:** Select to change the distance where the still image capture will occur during Auto Mode. Displays message box and on-screen keypad prompting you to enter the new value:
 - ♦ The range = 50 - 150 meters (50 - 500 feet)
 - ♦ The optimum and default value = 70 meters (229 feet)
- **DEVICE INFORMATION:** Double-tap "Display ..." to display the Device Information Screen (page 24).
- **DEVICE PARAMETERS:** Double-tap "Change ..." to display the Device Parameters Screen (page 25).
- **CROSSHAIR:** Use the stylus to select the crosshair style that will be displayed on vehicle images.

Classic (default) =  and Beam Size = 

- **FS CHECK:** FS CHECK stands for Linux File System Check and Repair. Double-tap "Proceed" to check the integrity of the SD Card file system. Figure #28 shows the screen that will be displayed during the check.

If necessary, the TruCAM is able to recover (repair) a damaged file system on the SD Card. The TruCAM will automatically start the FS Check if (1) the SD Card is accidentally rejected, (2) the battery pack is removed during use, or (3) the SD Card contains logically damaged files.

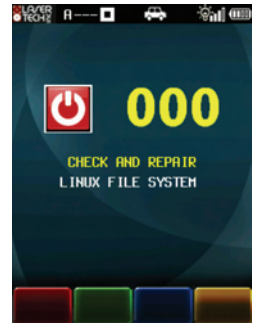




Figure #28

- The toolbar buttons are not active during the check.
 - Do not press the Power button during the check.
 - The TruCAM will power OFF when the check is complete.
 - If the SD Card is damaged, any recovered files will be located in the SD Card's root directory with an *.rec file extension.
 - With a logically damaged SD Card, some data or entire data may be lost.
- **LICENSE MANAGER:** The license manager is used to install additional software features on your TruCAM. For example, if you purchase DBC some time after receipt of your TruCAM, to activate the DBC feature you would enter a unique License Code into the License Manager.
 1. To activate the License Manager, double-tap "Enter the code."
 - ♦ The unique License Code will be provided by LTI or your Authorized LTI Dealer.
 - ♦ As Figure #29 shows, the License Manager message box will be displayed to prompt you to enter the unique code required for the feature that you want to activate.
 - The license code is unique to each software feature and to each individual TruCAM.
 - 18 characters, a combination of upper and lower case alpha-numeric.
 - ♦ Use the stylus and on-screen keypad to enter the alpha-numeric characters.
 - ♦ Verify that you entered the correct code.
 - ♦ Tap  or press the  soft key to accept the code.
 - A message box will be displayed to indicate that you entered the correct code. Tap OK to clear the message box.
 - If there is an error, an error message will be displayed. Tap OK to clear the error and then repeat the above steps.

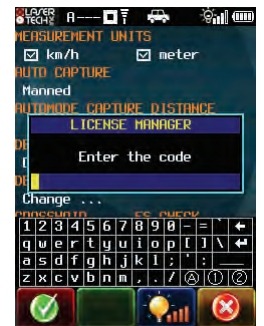














Figure #29

- **Icons at top of the LCD Touch Screen**
See page 69 for information about the icons that appear at the top of the LCD Touch Screen.

- **Tool Bar Buttons at the Bottom of the LCD Touch Screen**

Toolbar Button	Alternative Soft Key	Function
		Tap to scroll to the next option that appears on the screen.
		This button is displayed when a message box is displayed, prompting you change value associated with an option. Tap to close the message box and accept the value that you entered.
		Tap to select the option that you want to change.
		Tap to change the brightness of the LCD Backlight (page 17).
		Tap to save changes and return to the System Setup Screen (page 19).
		This button is displayed when a message box is displayed, prompting you to change value associated with an option. Tap this button to close the message box without changing the value.

Device Information Screen



System Options Screen

Device Information Screen

Figure #30



To display the Device Information Screen:





On the System Options Screen, double-tap "Display ..." that appears just below DEVICE INFORMATION.

• **VERSION:** TruCAM model, package and firmware version number.

In this example: TC100-1.17-1 / R2.6.0

- ♦ model = TC100 = TruCAM 100
- ♦ TruCore Version = 1.17-1
- ♦ TruCAM Version = R2.6.0

- **SERIAL AND FILM NUMBER:**
 - ♦ Serial Number: The serial number of your TruCAM. In this example = TC000018.
 - ♦ Film Number: 7-digit sequence number that is increased by '1' each time a *.jmf file is saved to the SD Card. The Film Number is not related to any particular SD Card. The information associated with the Film Number counter resides on the TruCAM and can not be reset. In Figure #30, the Film Number = 0000003 (The TruCAM with serial number TC000018 has stored a total of 3 *.jmf files).
 - ❗ • The last 3 digits of the Film Number are displayed during Capture Mode (page 34) and Playback Mode (page 43).
 - If the Battery Pack is accidentally removed or the SD Card is rejected while a *.jmf file is being saved, the Film Number may be not increased. The folder will have two *.jmf files that have the same Film Number and the first file will be damaged.
- **SELF TEST:** Displays the results of the power ON Self Test.
 - ♦ [0] indicates that all tests proved positive.
 - ♦ If all tests do not prove positive, the appropriate error code will appear in this field. For more information about Error Codes, see page 68. Example: [52] = temperature too low.
- **LINUX:** Operating system version number and information.
- **LICENSED FUNCTIONS:** Licensed programs that are active in your TruCAM
 - ♦ Default: SPEED: includes Speed Mode, Rear Plate Mode, Video Only Mode, Weather Mode, Night Mode (requires additional hardware)
 - ♦ Available Options: DBC and Dual Speed (Truck)
- **INSTALLED DEVICES:** Displays the devices that are installed in your TruCAM.
RTC = Real Time Clock GPS = Global Position System Receiver
- **LAST ALIGNMENT CHECK:** Displays the date and time of the last Scope Alignment Test (page 45).
 - ♦ Minimum of 5 test tones / TRIGGER activations
- **Icons at top of the LCD Touch Screen**
See page 69 for information about the icons that appear at the top of the LCD Touch Screen.
- **Tool Bar Buttons at the Bottom of the LCD Touch Screen**
 - ♦ The  and  soft keys are not active.

Toolbar Button	Alternative Soft Key	Function
		Tap to change the brightness of the LCD Backlight (page 17).
		Tap to return to the System Options Screen (page 22).

Device Parameters Screen



Changes are not saved until you tap or press the soft key. However, unsaved changes are valid until the TruCAM is powered OFF.



System Options Screen

Device Parameters Screen

Figure #31

On the System Options Screen, double-tap “Change ...” that appears just below DEVICE PARAMETERS. Use the stylus to select the option that you want to change. You can either double-tap the field, or tap the desired

field, and then tap or press the soft key.

Once you have selected an option, you can tap or press the soft key to scroll to the next option.

- **POWER OFF TIMER:** Instrument power OFF interval. The instrument will automatically power OFF if there is no activity for the specified time interval. Instrument activity includes any taps on the LCD Touch Screen, button presses or serial communication. Use the stylus and on-screen keypad to enter the desired time interval.

- ♦ Range = 300 to 7,200 seconds
- ♦ default = 600 seconds
- ♦ Entering a value that is invalid, displays a range error message (Figure #32). Tap OK and then enter a valid value.
- ♦ The Power OFF timer is disabled when Auto Mode is active.

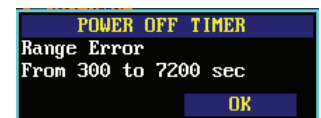


Figure #32

- **BACKLIGHT:** LCD Backlight power OFF interval. The LCD backlight will automatically power OFF if there is no activity for the specified time interval. Instrument activity includes any button presses or serial communication. Use the stylus and on-screen keypad to enter the desired time interval.
 - ♦ Range = 30 to 7,200 seconds
 - ♦ default = 120 seconds
 - ♦ Entering a value that is invalid, displays a range error message (Figure #33). Tap OK and then enter a valid value.
- **CAMERA POWER:** Camera power OFF interval. This is the time in seconds that live video is displayed without any activity while in Speed Mode.
 - ♦ Use the stylus and on-screen keypad to enter the desired time interval.
 - ♦ Range = 20 to 600 seconds
 - ♦ default = 60 seconds
 - ♦ Entering a value that is invalid, displays a range error message (Figure #34). Tap OK and then enter a valid value.
 - ♦ When the camera times out, the live video will be suspended. The image shown in Figure #35 will flash. Pull the trigger to activate camera.

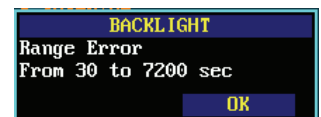


Figure #33

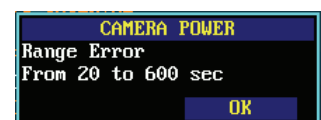


Figure #34

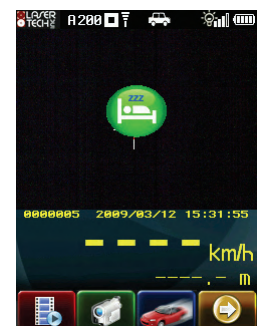


Figure #35

- **GPS INTERVAL:** The GPS does not sense location continuously. Based on this time interval, the GPS will wake up, sense the current date, time, location, update the system, and then shut down. The default interval is 60 seconds. Use the stylus and on-screen keypad to enter the desired time interval. Figure #36 shows the message box that will be displayed.

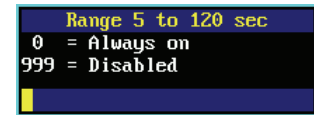


Figure #36

- ♦ Range = 5 to 120 seconds
- ♦ Entering a value that is invalid, displays a range error message. Tap OK and then enter a valid value.
- ♦ Example: When the interval is set to 60 seconds, the GPS sensor will sense and update the location every 60 seconds.

i Default Setting: the GPS senses location and provides rough information only. It does not try to get precise location information. The default setting is designed for battery life.

- **GPS Interval = 0:** Prevents the GPS from powering OFF. The continual on-time will shorten battery life.
- **GPS Interval = 999:** Disables GPS, but still receives 2D fix and provides time and date information. This option extends battery life.
- **DATE FORMAT:** Selectable date format. Use the stylus and on-screen keypad to toggle the value.
 - ♦ YYYY/MM/DD (default)
 - ♦ MM/DD/YYYY
 - ♦ DD/MM/YYYY
- **FRAME RATE and TRACK STORAGE:** Default values are based on the Video Mode selection (System Setup Screen, page 19). Changing the Frame Rate automatically adjusts the Track Storage. Use the stylus or the soft keys to toggle the Frame Rate and Track Storage values. Track Storage may be changed independently of the Frame Rate.
 - **FRAME RATE:** Selectable video capture frame rate *before the measurement* and based on motion clip size selection. Use the stylus to toggle between the possible values listed in the table below. This selection effects *.jmf file size. Larger number frames per seconds will result in larger *.jmf files.

240x180 pixels Coarse Motion Clip Mode		480x360 pixels Fine Motion Clip Mode	
Typical # Frames/jmf file = 250		Typical # Frames/jmf file = 125	
Frame Rate (per second)	24	Frame Rate (per second)	14
	18		11
	12		9

- **TRACK STORAGE:** Selectable frame storage *after the measurement* and based on the current Frame Rate. Use the stylus or the soft keys to toggle the value. Possible values are listed below. This selection effects *.jmf file size. Larger number of tracks stored will result in larger *.jmf files.

- ♦ approximately 1/3 of the Frame Rate
- ♦ same as the Frame Rate
- ♦ approximately 1/6 of the Frame Rate

i The equations below can be used to estimate Tracking Time and Tracking Distance.

Tracking Time (seconds) = (typical # frames - 2 * Frame Rate) / Track Storage



Tracking Distance = Vehicle Speed * Tracking Time

Example: Coarse Motion Clip, Frame Rate = 24 frames/second, Vehicle Speed = 30 km/h = 8 m/sec

Tracking Time = (250 frames - 2*24 frames/second) / 8 frames = 25 seconds

Tracking Distance = (8 meters/second * 25 seconds) = 200 meters

- **ALIGN SCREEN:** See page 50.

- **PASSWORD:** Follow the steps below to change the user password.
 1. Use the stylus to double-tap "Change ..." to change the user password. Figure #37 shows the message box that will be displayed.
 2. Use the stylus and on-screen keypad to enter the current user password.
 3. Use the stylus and on-screen keypad to enter the new password:
Minimum = 5 characters and maximum = 23 characters.
Figure #38 shows the message box that will be displayed.
 4. Use the stylus and on-screen keypad to re-enter the new user password (Figure #39).
 - If new user password passes verification, the Device Parameters screen will be displayed.
 - If the new user password fails verification, an error message displays. Tap OK.
The Device Parameters Screen will be displayed. Repeat the above steps.
 - Tap  or press the  soft key to cancel without changing the user password.

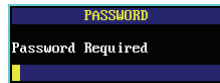


Figure #37

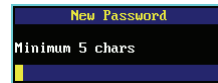


Figure #38

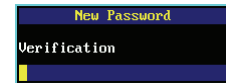















Figure #39

-  The default user password = admin
- Resetting the factory default settings restores the default user password.
- If you cannot remember current user password, contact your authorized LTI Dealer or LTI for assistance. See inside front cover for LTI contact information.

- **RESET SETTINGS:**
See page 50.

- **Icons at top of the LCD Touch Screen**
See page 69 for information about the icons that appear at the top of the LCD Touch Screen.

- **Tool Bar Buttons at the Bottom of the LCD Touch Screen**

Toolbar Button	Alternative Soft Key	Function
		Tap to scroll to the next option that appears on the screen.
		This button is displayed when a message box is displayed, prompting you change value associated with an option. Tap to close the message box and accept the value that you entered.
		Tap to select the option that you want to change.
		Tap to change the brightness of the LCD Backlight (page 17).
		Tap to save changes and return to the System Setup Screen (page 19).
		This button is displayed when a message box is displayed, prompting you to change value associated with an option. Tap this button to close the message box without changing the value.

Section #4 - Roadside Laser/Camera Setup

Choosing a Roadside Location

When choosing a spot on the side of the road for measuring moving vehicles, you will need to consider:

- Is the location safe?
- Do you have a clear line of sight?
- What is the approximate angle between the instrument's position and the target vehicle's direction of travel?
- What is the approximate distance to the target vehicles?
- How is the weather? Will you need to use the Weather Mode?
- Where is the sun located? Ideally, it is best to setup with the sun on your back, behind the Camera. This ensures the license plates and the LCD Touch Screen are both illuminated as much as possible. It is also acceptable to setup with the sun to your left or right. Setting up with the Camera aimed directly into the sun is not recommended and will not result in good images.

❗ The optimum targeting distance is 70 meters (230 feet), but good illumination and focus can increase this distance. Conversely, there is less natural light available on cloudy days so it may be necessary to decrease the targeting distance.

- Hand-held: 15 - 80 meters (50 - 262 feet)
- Tripod mounted: 15 - 90 meters (50 - 295 feet)

Line of Sight

Ideally, you should have a clear line of sight to the target vehicle.

- *If there is a momentary break in the laser measurement beam*, the instrument will accumulate data and may be able to capture the target vehicle's speed. The instrument will display an error message if it cannot capture the target vehicle's speed.
- *If there is an extended break in the laser measurement beam*, the instrument will display an error message.

The Cosine Effect

If the target vehicle is moving directly toward or away from you, the speed measured by the TruCAM is identical to the vehicle's true speed. However, the instrument is usually set up on the side of the road for safety. This results in an angle between the instrument's position and the target vehicle's direction of travel. When the angle is significant, the measured speed is less than the target's true speed. The phenomenon is known as the cosine effect. Cosine is the trigonometric function that relates to this phenomenon.

The difference between the measured speed and the true speed depends upon the angle between the instrument's ideal position, the position where targets would be moving in direct line with the instrument, and its actual position.

- ❗ • The larger the angle, the lower the measured speed.
- The effect always works to the motorist's advantage.
- Loosely speaking, the cosine effect is not significant as long as the angle remains small.

Measured Speed by Angle: The Cosine Effect:

METRIC					
Angle (degrees)	True Speed				
	50 km/h	70 km/h	90 km/h	110 km/h	130 km/h
	Measured Speed (km/h)				
0	50.00	70.00	90.00	110.00	130.00
1	49.99	69.99	89.99	109.98	129.98
3	49.93	69.90	89.88	109.85	129.82
5	49.81	69.73	89.66	109.58	129.50
10	49.24	68.94	88.63	108.33	128.02
15	49.30	67.62	86.93	106.25	125.57
20	46.98	65.78	84.57	103.37	122.16
45	35.36	49.50	63.64	77.78	91.92
90	00.00	00.00	00.00	00.00	00.00

IMPERIAL					
Angle (degrees)	True Speed				
	30 MPH	40 MPH	50 MPH	60 MPH	70 MPH
	Measured Speed (MPH)				
0	30.00	40.00	50.00	60.00	70.00
1	29.99	39.99	49.99	59.99	69.99
3	29.96	39.94	49.93	59.92	69.90
5	29.89	39.85	49.81	59.77	69.73
10	29.54	39.39	49.24	59.09	68.94
15	28.98	38.64	48.30	57.94	67.61
20	28.19	37.59	46.99	56.38	65.78
45	21.21	28.28	35.36	42.43	49.50
90	00.00	00.00	00.00	00.00	00.00

The cosine effect decreases as the range to the target vehicle increases.

At the maximum range of the instrument, the vehicle is so far away that the angle between it and the instrument is very small indeed. The instrument's perception of the target's speed is identical to its true speed.

As the vehicle approaches, the angle increases until it becomes large enough to affect the measurement.

- ❗ To minimize the cosine effect, keep the angle small. Set up the instrument as close to the road as possible without creating safety risks, and target down the road at ranges sufficient to keep the angular difference small.

The table below shows acceptable parameters for minimizing the cosine effect. The chart indicates the percentage of true speed measured, given the distance from the roadway and the distance from the target vehicle. To find a target's measured speed, multiply the true speed by the number in the chart.

METRIC						IMPERIAL					
Distance off the roadway (meters)	Range to Target Vehicle					Distance off the roadway (feet)	Range to Target Vehicle				
	30 m	100 m	150 m	300 m	600 m		100 ft	250 ft	500 ft	1000 ft	2000 ft
	fraction of the True Speed that will be measured						fraction of the True Speed that will be measured				
3	.9950	.9995	.9998	.9999	1.0000	10	.9950	.9992	.9998	.9999	1.0000
10	.9682	.9950	.9987	.9997	.9999	25	.9682	.9950	.9987	.9997	.9999
15	.8660	.9886	.9950	.9987	.9997	50	.8660	.9798	.9950	.9987	.9997
30	.0000	.9539	.9798	.9950	.9987	100	.0000	.9165	.9798	.9950	.9987
60	.0000	.7999	.9165	.9798	.9950	200	.0000	.6000	.9165	.9798	.9950

Remember that the cosine effect is always in the motorist's favor.

- ❗ As a general rule:
 - METERS:** Do not exceed 1 meter off the road for every 10 meters shooting down range to the targets. If target vehicles will be 150 meters down the road, set up no more than 15 meters off the road.
 - FEET:** Do not exceed 10 feet off the road for every 100 feet shooting down range to the targets. If target vehicles will be 500 feet down the road, set up no more than 50 feet off the road.

Adjusting Camera Settings

The Camera's default settings are set for optimum results in a typical situation. You may need to adjust some settings based upon your preference or current location.

Depth of Field

The depth of field (DOF) is a unit of measurement that represents the range of distances within an image where the focus is acceptably sharp. This is the distance in front of and beyond the subject that appears to be in focus. The DOF is determined by the subject distance, the lens focal length and the lens F-stop. On the TruCAM, you cannot change the distance and the lens focal length, so only the F-stop is variable. The TruCAM is able to adjust gain in accordance of the aperture. During a capture session, a larger f-number is better.

The two images to the right have the same focus, but the f-number of Figure #42(A) is 5.6 and Figure #42(B) is 16. In Figure #42(B), the DOF is from the mosquito net to the pine tree.

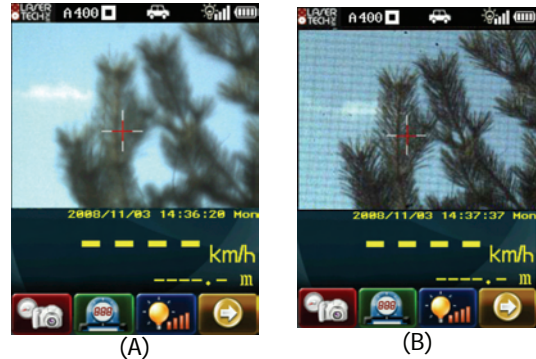


Figure #42


Iris

Iris is an adjustable aperture used to control the amount of light coming through the lens. The more the iris is opened, the more light it lets in and the brighter the image will be. Aperture is the unit of measurement that defines the size of the opening in the lens that can be adjusted to control the amount of light that reaches the digital sensor. The size of the aperture is measured in F-stop. The Iris Adjustment Ring may be positioned on an F-stop or anywhere in between two F-stops.



- In any type of environment, maintain the biggest f-number possible.
 - The smaller the f-number, the bigger the opening (more light).
Typical value on cloudy or foggy day = 8 to 11.
 - The bigger the f-number, the smaller the lens opening (less light).
Typical value on sunny day = 11 to 16.


Automatic Gain Control

Automatic Gain Control (AGC) optimizes picture quality at all times during the day. It increases the video signal at low light levels to make the picture brighter. If the majority of the image is dark, AGC will adjust the entire image to make it more easily viewable. See page 32 for information about AGC threshold.

This option is available during the Capture Mode. Tap  or press the  soft key to toggle AGC ON or OFF.





If the  toolbar button is not displayed, tap  or press the  soft key.

- **ON:** The  icon is displayed at the top of the LCD Touch Screen and AGC electronically adjusts the camera to the proper light level..
- **OFF:** The  icon is not displayed at the top of the LCD Touch Screen.

 AGC can not compensate for all lighting conditions and typically must be used in conjunction with an adjustment of the lens iris.

Camera Lens Focus Distance

During assembly, the Camera is focused for 70 meters (229 feet). This setting provides sharp images from 50-150 meters (150 to 500 feet).

1. Pull the TRIGGER to start the Capture Mode.
2. Tap  or press the  soft key twice to display and then tap  or press the  soft key to use the zoom function to optimize the view.
3. Locate a target with defined lines on it. A street sign is ideal. The target should be at the Video Tracking Distance set on the System Setup Screen.
4. Open the Camera Cover to access the Focus Adjustment Ring and the Iris Adjustment Ring.
5. Aim the TruCAM at the target and adjust the lens iris for the best amount of light entering the camera.

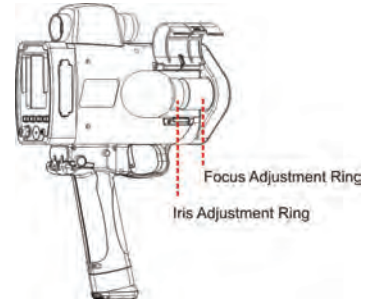




Figure #43

- ❗ Focus the Camera so you can easily read the target vehicle's license plate and readily recognize the surrounding roadway.
 - Hand-held: 15 - 80 meters (50 - 262 feet)
 - Tripod mounted: 15 - 90 meters (50 - 295 feet)

Shutter Speed

Shutter speed is the length of time that the shutter remains open as the image is captured, and is very critical for image quality. Choose faster speeds as much as possible. The shutter speed and aperture together control the total amount of light reaching the sensor. Shutter speeds are expressed in fractions of a second. Lower shutter speeds provide larger F-stop number, and in turn result in a larger DOF.



- ❗ Shutter speed may not be displayed during Playback Mode.



This option is available during the Capture Mode. Tap  or press the  soft key to change the shutter speed. The current shutter speed is displayed at the top of the LCD Touch Screen. See page 69 for information about the icons that appear at the top of the LCD Touch Screen. The actual shutter speed is inversely related to the speed value displayed, so to increase the shutter speed you would select a smaller setting.







- ❗ Range: 2K0 = 1/2000 second (bright day) to 200 = 1/200 second (dark day)
 - 200 is suitable for dark environments.
 - 400 is suitable for lower speed zones.
 - 600 is suitable for faster speed zones.
 - Higher shutter speeds may be suitable for bright environments and test/alignment.

White Balance & AGC Threshold

Adjusting the White Balance compensates for lighting conditions, and allows the camera to “see” the color white under a given lighting condition. To attain proper white balance, red and blue can be adjusted while green is fixed.

- i** Changes are not saved until you tap  or press the  soft key. However, unsaved changes are valid until the TruCAM is powered OFF.

This option is available during the Capture Mode. Tap the  or press the  soft key. White Balance has four settings:

- Red: Default = 1024 and can be adjusted from 644 to 1344.
To increase tap , and to decrease tap .
- Green: Fixed at 1024 and can not be adjusted.
- Blue: Default = 1024 and can be adjusted from 644 to 1344.
To increase tap , and to decrease tap .
- White (Intensity): Default = 128 and can be adjusted from 0 (dark) to 255 (light).
To increase tap , and to decrease tap .
- AGC threshold can be adjusted from 100 to 159. 100=darkest and 159=lightest. Default = 128.

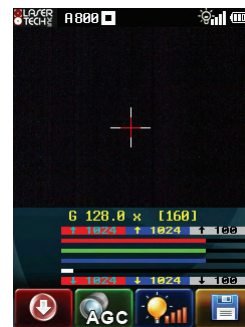


Figure #44

Attaching / Removing the Shoulder Stock

The Shoulder Stock helps stabilize the TruCAM and is designed for either left-handed or right-handed use.

Attaching the Shoulder Stock

1. Rotate the Shoulder Stock Release toward the front of the TruCAM.
2. Align the pronged-end of the Shoulder Stock with the Shoulder Stock Attachment Point as shown in Figure #45.
3. Slide the Shoulder Stock straight into the two holes.
4. Rotate the Shoulder Stock Release toward the rear of the TruCAM to secure the Shoulder Stock.



Figure #45

Removing the Shoulder Stock

1. Turn the Shoulder Stock Release toward the front of the TruCAM.
2. Continue to hold the Shoulder Stock Release in this position.
3. Pull the Shoulder Stock straight toward you.

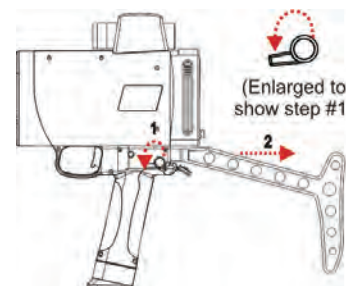


Figure #46

Attaching / Removing the Sun Shade

Your decision to use the Sun Shade may depend on weather conditions. You may find it useful on bright, sunny days.

Attaching the Sun Shade

1. Align and insert the two large tabs on the back of the Sun Shade with the two slots above the LCD Touch Screen.
2. Press down and rotate the cover into position until the pegs lock on the notches located one on each side of the LCD screen.

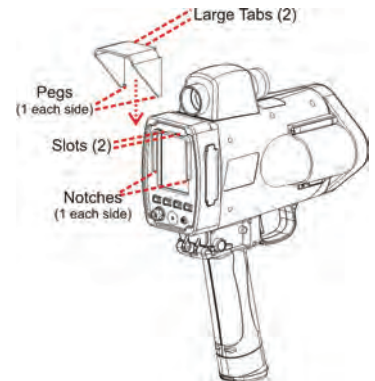


Figure #47

Removing the Sun Shade

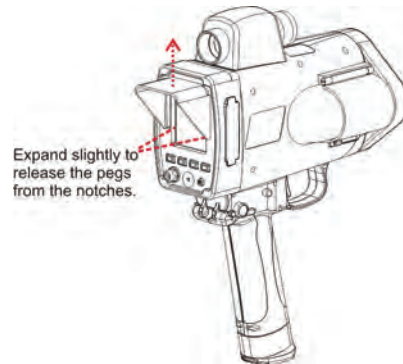


Figure #48




























Section #5 - TruCAM Capture Modes

During the Capture Session


During the capture session, you should monitor the following items:


- **Battery Charge.** It is recommended that the TruCAM be charged to the maximum prior to any field acquisition. See page 12 for information about the Battery Voltage Icon.
- **File Space Available on the SD Card for Additional Images.** This information is available on the System Setup Screen (page 19). During the capture session, briefly press the Power Button to display the System Setup Screen and then double-tap the area indicated as "Tap here" to the right of Memory Usage. For a 4 GB SD card, the average is approximately 2,000 files stored.
- **Image Quality.** During the capture session, changing weather conditions or location of the sun may affect image quality. If the image quality is not optimum, it may be necessary to adjust camera settings (page 30).

Toolbar buttons that appear at the Bottom of the LCD Touch Screen.

Toolbar Button	Alternative Soft Key	Function
		Playback Mode (page 43). The most recently captured image will be displayed.
 		Video Only Mode (page 37). Rear Plate Mode (page 37). This button is only displayed when the Video Only Mode is active.
		Speed Measurement Mode (page 35).
		Tap to advance to the next three options on the Capture Session Toolbar.
		Tap to adjust Shutter Speed (page 31).
		Tap to adjust the intensity of the aiming reticle and HUD (page 13).
		Tap to adjust the intensity of the LCD backlight (page 17).
		Night Time Mode. Hardware requirements apply. This manual does not cover this mode, it is covered in a separate document.
		Weather Mode (page 36).
		Zoom Function. Tap to enlarge detail of the displayed image. Coarse Motion Clip Mode includes normal display and 3 levels of zoom (page 69). Fine Motion Clip Mode includes normal display and 1 level of zoom (page 69).
		Tap to adjust White Balance (page 32).
		Tap to toggle AGC ON or OFF (page 30).
		Auto Mode (page 37).

Speed Mode

Speed Mode is the default capture mode. When this mode is active the  icon is displayed at the top of the Touch Screen as Figure #49 shows. If another feature of the Capture Mode is

active, tap  or press the  soft key to start the Speed Mode.

1. Select your location and adjust the camera settings (Section #4 - Roadside Setup).
2. Power ON the TruCAM.
3. Use the aiming reticle to aim the instrument at the target vehicle's license plate and pull the TRIGGER.
4. Continue to pull the TRIGGER and keep the instrument sighted on the target.
 - A low-pitched growl means that the instrument is attempting to lock onto the target.
 - A low-pitched beep means that a measurement error occurred. An error message will be displayed (page 68).
 - A high-pitched single beep means that a speed was captured. The measured speed will be displayed on the LCD and projected in the scope just below the aiming reticle.

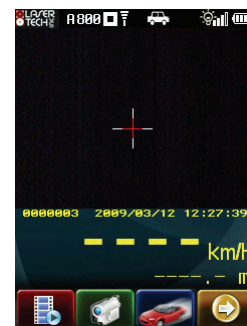


Figure #49

While the instrument is attempting to lock onto the target, as long as the TRIGGER is kept pressed, it will retry the speed measurement.

- The instrument will attempt to lock onto the target for up to 5 seconds. Information is accumulated until it gets a good measurement or generates an error message.
- Consequently, it is very important that the aiming point on the target remain constant for the entire measurement time. If you move the instrument off the aiming point, it will generate an error code instead of capturing a speed reading.
- ① • If Video Tracking is enabled (page 19), when the target vehicle reaches the specified distance, the camera will capture the still image of the vehicle.
 - Video Tracking will stop if you move off the target, the laser measurement beam is interrupted, or the maximum file size is exceeded.
- If Video Tracking is disabled, the still image is captured when the speed is measured. Image quality may be poor if the target vehicle is not in the camera focus range.

After you release the TRIGGER, the instrument will display the speed reading and the distance at which it was captured or an error message.

- The speed displays as a negative number if the target was going away from you when it was measured.
- The speed displays as a positive number if the target was approaching you when it was measured.

The TruCAM will compare the measured speed to the Capture Speed Limit (System Setup Screen, page 19).


- If the measured speed is greater than or equal to the Capture Speed Limit, the motion clip / still image and the related measurement data will be saved to the SD Card.
- If the measured speed is less than the Capture Speed Limit, no data is saved to the SD Card.

5. Repeat steps #3 and #4 to capture each additional speed measurement motion clip / still image.




Weather Mode

Moisture is reflective. Weather such as rain, snow, or fog can make it difficult for the laser to receive signals back from the target vehicle. This is especially true when you are trying to capture speeds at close range. The TruCAM includes a built-in Weather Filter that, when it is active, it is applied when the laser is fired. When the Weather Mode is active, the factory-defined gate setting increases the instrument's minimum range from 15 meters to 61 meters (50 feet to 200 feet). Increasing the minimum range ensures that the laser only acquires targets beyond the range where weather affects the laser's ability to capture a speed reading.

When this filter is active :

- The  icon is displayed at the top of the Touch Screen as Figure #50 shows.
- Targets must be a distance greater than 61 meters (200 feet).
- The instrument's maximum range is not changed.
- Other than the above items, the TruCAM operates the same as when the Weather Mode is not active.

To activate the Weather Mode.

1. Ensure that the TruCAM is powered ON and that the Capture Mode is active.
2. Tap  to display the other options on the Caption Session Toolbar.
3. Tap  or press the  soft key to activate the Weather Filter.
4. Proceed with making a normal speed measurement as described on the previous page.

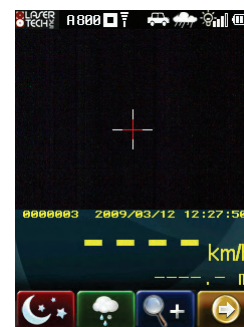


Figure #50

Auto Mode

 Your TruCAM may not include Auto Mode. It is a factory-defined option that is set when the instrument is shipped.

The process of measuring the speed and distance is the same as in the Speed Mode. The difference is that in this mode, a range gate is applied and the laser fires continuously as it acquires targets. Options for this mode are set on the System Options Screen. You can select Manned or Unmanned Mode and also set the Camera Lens Focus Distance (range gate).

Choosing a Location

When choosing a roadside location, setup the TruCAM so the laser is aimed parallel to the ground. Figure #51 shows an example of targeting vehicles while aiming downhill. From location (A), the laser is aimed parallel to the ground, an approaching vehicle will make only one dimensional movement in the terms of the TruCAM's view which is optimum. From location (B), the laser is not aimed parallel to the ground, an approaching vehicle will make two dimensional movements in the terms of the TruCAM's view.



Figure #51


Manned Mode

Select this mode if there is an operator observing each measurement who can provide an independent confirmation of the target vehicle and estimated speed. In this mode only a still image is produced. 1 to 2 measurements per second are possible (depends on image size selected).

Unmanned Mode

Select this mode if an operator is not present. The system takes a small motion clip in addition to the still image. Due to the extra processing, only 1 measurement per 1 to 2 seconds is possible (depends on image size selection). The extra motion clip is used to calculate an estimated speed of the target vehicle as a secondary confirmation to the primary laser speed measurement.

Auto Mode Speed Measurements

When this mode is active the  icon is displayed at the top of the LCD Touch Screen as Figure #52 shows.











1. Ensure that the TruCAM is powered ON and that the Capture Mode is active.
2. Tap  to display the other options on the Caption Session Toolbar.
 - To start Auto Mode, tap  or press the  soft key.
 - You will want to target vehicles at approximately the distance set as the Camera Lens Focus distance on the System Options Screen.
 - ① The laser will start firing immediately, but NO images will be stored until you tap  press the  soft key, or 5 minutes has elapsed. This allows time to properly setup the instrument, position the crosshair, and view image capture onscreen without storing data. During the setup process, all passing vehicles are captured (but not stored) no matter how their speed compares to the Capture Limit.
3. To exit Auto Mode, tap  or press the  soft key.



Figure #52

Rear Plate Mode

Rear Plate Mode can be used when targeting an approaching motorcycle or other vehicle that does not have a front license plate. The process of measuring the speed and distance is the same as in the Speed Mode. The difference is that in this mode, after the speed measurement has been taken, continue to hold the TRIGGER and track the vehicle as it passes. Keep the camera on the target until it is on the rear license plate and then release the TRIGGER. The still image is captured when you release the TRIGGER.

When this mode is active the  icon is displayed at the top of the LCD Touch Screen as Figure #53 shows. To start the Rear Plate Mode, tap  or press the  soft key.

- ① • Image quality may be poor if the target vehicle is not in the camera focus range when you release the TRIGGER.
- In this mode, target vehicles will always be approaching, therefore, all measured speeds will be positive values.

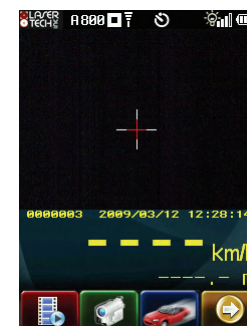






Figure #53

Video Only Mode

When this mode is active, the TruCAM captures video images only.

The  icon is displayed at the top of the Touch Screen and  appears just above the toolbar buttons as Figure #54 shows.

To start the Video Only Mode, tap  or press the  soft key. Since speed measurements are not captured, pressing the TRIGGER does not fire the laser.

1. Power ON the TruCAM.
2. Start the Video Only Mode.
3. Use the aiming reticle to aim the instrument at the target and pull the TRIGGER.
4. Continue to press the TRIGGER and keep the instrument sighted on the target. Video will be captured as long as you hold the TRIGGER.

- ① Maximum recording is up to 2 minutes or 8 MB, whichever occurs first. Since the *.jmf file includes the image data and file header information, the actual file size may be larger than 8 MB.



Figure #54

Distance between Cars (DBC)

- i** Your TruCAM may not include DBC. It is an optional feature that requires a unique License Code be entered in the License Manager on the System Options Screen (page 20). If purchased at the same time as your TruCAM, the DBC license will be activated at the factory. If purchased separate from your TruCAM, this license may be purchased from either your Authorized LTI Dealer or LTI.

DBC is defined as the “back-to-front” bumper separation between two vehicles (see Figure #55). In DBC Mode, you aim the TruCAM at the first (leading) vehicle, take the measurement, aim at the second (trailing) vehicle and take the measurement. The DBC results are displayed at the bottom of the LCD Touch Screen.

Since it is not possible to directly measure the back-to-front separation, a back-to-back or front-to-front measurement is made and used to calculate the displayed DBC value. This approach biases the DBC value in favor of the trailing vehicle by the length of the leading (or trailing) vehicle.

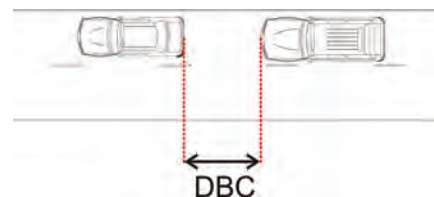


Figure #55

Selecting a Location

1. Select a location that is safely off the side of the road.
2. Make sure you have a clear line of sight.
3. Make sure that you have enough distance to visually track the vehicles before measuring the DBC with the TruCAM.

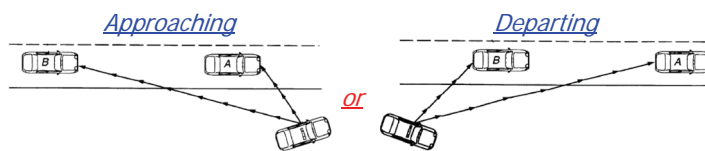




Figure #56

- i** • As shown in Figure #56, your measuring position may be in front of the lead vehicle for approaching traffic or to the rear of the trailing vehicle for departing traffic.
- To optimize the measurement geometry for the best possible results, the DBC measurement sequence should be to the lead vehicle first and then to the trailing vehicle.

Roadside Offset

The Roadside Offset is equal to the distance from the location where you are taking the DBC measurement to the mid-point or center of the road where the vehicle is travelling. The offset is used to eliminate any bias in the DBC calculation due to the cosine effect (page 28). As Figure #57 shows, when DBC is enabled the System Setup Screen includes a Road Offset value located in the bottom right corner.

- i** • When entering the Roadside Offset, keep in mind that the minimum capture distance is a 2.5-to-1 ratio.
- Example: If your Roadside Offset is 10 meters, the minimum capture distance to either target vehicle would be $10 \text{ meters} \times 2.5 = 25 \text{ meters}$.
- You may either use the TruCAM to measure the Roadside Offset Distance or manually enter the Roadside Offset Distance.
 - The default value is 5.0 meters (16.4 feet).
 - Manual entry: valid range limit between 1.0 and 100.0 meters (3 and 300 feet).
 - Laser entry: range limits are ignored.
 - Changes to the System Setup Screen are not saved until you tap  or press the  soft key. However, unsaved changes are valid until the TruCAM is powered OFF

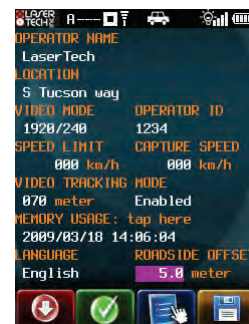


Figure #57

Entering the Roadside Offset:

Use the stylus or the soft keys to select the Roadside Offset. Figure #58 shows the message box that will be displayed.

- *Using the Laser to Measure the Roadside Offset Distance:*
 1. Select the "Laser Measure" option:
Use the stylus to tap the [1] field in the message box, tap the button, or press the soft key. The screen should similar to Figure #59 (left).
 2. Aim to the center of the lane of travel and press the trigger. The measured distance will be displayed at the bottom of the screen as Figure #59 (right) shows.
 3. Tap the or press the soft key to save this value or repeat step #2 if you want to change the measured value.
- *Manually Entering the Roadside Offset Distance:*
 1. Select the "Key In" option:
Use the stylus to tap the [2] field in the message box, tap the button or press the soft key. Figure #60 shows the message box that will be displayed.
 2. Use the stylus and on-screen keypad to enter the desired Roadside Offset.
 - Range = 1 to 100 meters (3 to 300 feet)
 - default = 5.0 meters (16.4 feet)
 3. Tap or press the soft key to accept the entered value.



Figure #58



Figure #59



Figure #60

Taking the DBC Measurement

When DBC Mode is active the icon is displayed at the top of the Touch Screen as Figure #61 shows.

Tap or press the soft key to start the DBC Mode. Remember to set the Roadside Offset (page 39) before taking any DBC measurements.

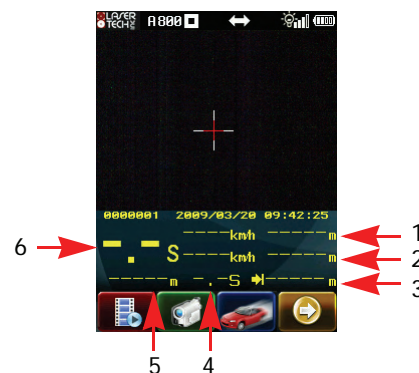


Figure #61

1. Vehicle #1 (speed & distance)
2. Vehicle #2 (speed & distance)
3. Roadside Offset
4. Time between Measurements
5. Distance between Vehicles
6. Time between Vehicles

1. Aim to the first/leading vehicle of the pair and pull the trigger to take a measurement. The measured speed and distance will be displayed, (1) in Figure #61.
2. Aim to the second/trailing vehicle of the pair and pull the trigger to take a measurement. The results of the DBC measurement will be displayed and should look similar to Figure #62. The crosshair displayed on the image represents when the second/trailing vehicle was targeted.
3. Repeat steps #1 and #2 to capture additional DBC measurements.

- i** • If either vehicle measurement generates an error, the instrument will beep and return to the initial DBC screen, resetting the sequence.
- The time between the first and second measurements must be less than three seconds. Otherwise, the instrument will emit a low-pitched beep, cancel the operation, and return to the initial DBC screen.
 - Restoring the default configuration resets the Roadside Offset to the default value.



Figure #62



DBC Measurement Requirements

- Time Limit between Measurements: 3 seconds
 - Minimum distance between vehicles: 4 meters (13.12 feet)
 - Minimum Vehicle Speed: 5 km/h (3 mph)
 - Maximum Speed Difference between Target Vehicles: 8 km/h (5 mph)
 - Minimum Capture Distance: 2.5 times the Road Offset Distance
- i** • The Minimum Capture Distance is the minimum distance that the TruCAM will accept a DBC measurement.
- The Minimum Capture Distance is 2.5 times Roadside Offset distance entered by the user.
 - If a vehicle measurement is taken and the distance to the vehicle is less than the Minimum Capture Distance an error message is displayed and the measurement is aborted.
 - Measurements are always made front-to-front of each vehicle, or rear-to-rear. A front-to-rear or rear-to-front measurement will result in an error message displayed and no DBC value will be calculated/displayed.

Dual Speed (Truck) Mode

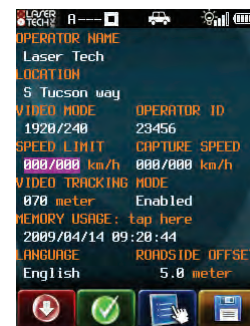
- i** Your TruCAM may not include Dual Speed Mode. It is an optional feature that requires a unique License Code be entered in the License Manager on the System Options Screen (page 20). If purchased at the same time as your TruCAM, the license will be activated at the factory. If purchased separate from your TruCAM, the Dual Speed license may be purchased from either your Authorized LTI Dealer or LTI.

The Dual Speed Mode is intended for use in locations that have separate, posted speed limits for passenger vehicles and high-profile transport trucks. Dual Speed Mode allows the TruCAM to automatically differentiate between cars and trucks and apply the appropriate speed limit.

- Dual Speed Mode is enabled on the System Options Screen as shown in Figure #63. Use the stylus to toggle TRUCK SPEED from "Disabled" to "Enabled".
 - Changes to the System Options Screen are not saved until you tap  or press the  soft key. However, unsaved changes are valid until the TruCAM is powered OFF.





System Options Screen



System Setup Screen

Figure #63

- When Dual Speed Mode is enabled, you will be prompted to enter two Speed Limits and two Capture Speeds on the System Setup Screen.
 - Use the stylus and on-screen keypad to enter the desired Speed Limits and Capture Limits. As Figure #64 shows, the first value entered applies to Cars and the second applies to Trucks, and the two values must be separated by a comma.
 - Example: To enter 55 km/h for Cars and 35 km/h for Trucks, you would enter 55,35.
 - With a Capture Speed of 55 for Cars and 35 for Trucks, any speed below 35 will not be captured. All speeds over 55 will be captured. Only trucks will be captured between 35 and 55.
 - When the Dual Speed Mode is enabled, it is only active when Auto Mode is active. See page 36 if you are not familiar with Auto Mode setup and operation.
 - Changes to the System Setup Screen are not saved until you tap  or press the  soft key. However, unsaved changes are valid until the TruCAM is powered OFF.

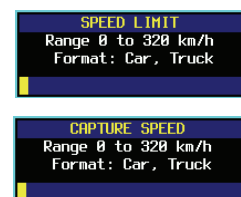


Figure #64

- i** When using Dual Speed Mode, LTI recommends:

- Using the TruCAM on a tripod.
- Setting the Camera Lens Focus Distance to a minimum of:
 - 80 meters (240 feet) for approaching vehicles.
 - 70 meters (210 feet) for departing vehicles.

Vehicle Classification

Vehicle classification uses computer vision technology and is designed for tripod application. The TruCAM automatically differentiates between cars and trucks by taking into account the range to the vehicle and evaluating the number of pixels the vehicle occupies in the image. The factory default Truck Size is 210 cm x 240 cm. Depending upon your location, the default Truck Size may vary. Figure #65 shows an example of good positioning.

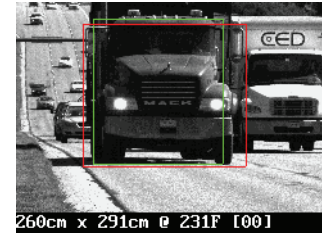


Figure #65

- ❗ • This function is designed to be reviewed by human beings or verified by a vehicle license database.
- When image processing fails to classify the vehicle type, an error message will be displayed. You will want to clear the error message and retry the measurement. The following situations may cause error messages:
 - Targeting a vehicle that is too close.
 - Targeting multiple lanes of traffic.
 - Targeting downhill or multiple vehicles are moving in the camera field of view.

Dual Speed Measurements















1. Enable TRUCK SPEED on the System Options Screen.
2. Enter the two Speed Limits and two Capture Limits on the System Setup Screen.
3. Pull the trigger to start the Capture Mode.
 - To start Auto Mode, tap  or press the  soft key. When this mode is active the  icon is displayed at the top of the LCD Touch Screen.
 - You will want to target vehicles at approximately the distance set as the Camera Lens Focus distance on the System Options Screen.
 - ❗ The laser will start firing immediately, but NO images will be stored until you tap  press the  soft key, or 5 minutes has elapsed. This allows time to properly setup the instrument, position the crosshair, and view image capture onscreen without storing data. During the setup process, all passing vehicles are captured no matter how their speed compares to the Capture Limit.
 - To exit Auto Mode / Dual Speed Mode, tap  or press the  soft key.
4. Target the TruCAM as you normally would in Auto Mode. Figure #66 shows an example where the vehicle was classified as a Truck which is represented by the "T" which appears to the left of the date.



Figure #66

Section #6 - Playback Mode

To view previously captured motion clips / still images tap either  (yellow) or  (red):

- : Is available on the System Setup Screen.
- : Is available on the Capture Menu. If it is not displayed, tap  repeatedly or press the  soft key repeatedly until  is displayed.

The most recently captured still image will be displayed as shown in Figure #67.











- Initially, a preview of the file will be displayed.
- Tap the  or press the  soft key to load the motion clip and still image data.
- To display the GPS data associated with the motion clip/still image, use the stylus to tap the Time/Date data and toggle between Time/Date and GPS.





Figure #67

Toolbar Button	Alternative Soft Key	Function
		Tap to display the previous image in the current folder.
		Tap to display the list of folders that are stored on the SD Card.
		Tap to display the next image in the current folder.
		Tap to load the video and still image.

Displaying the Folders Stored on the SD Card









The TruCAM creates a folder each day that the TruCAM is used. Figure #68 shows

an example of the screen that will be displayed when you tap  or press the  soft key. The current date is assigned as the folder name when the folder is created. In this example, there are 11 folders. The highlighted folder is from December 22nd and contains 16 *.jmf files.



- The screen can display a maximum of 28 folders. If your SD Card contains more than 28 folders, the most recent 28 are displayed. In this case you will need to transfer the folders to your Office PC using the [1] TruCAM Image Viewer Program (page 52) or [2] USB connection (page 15). Once the files have been transferred, then you can use the TruCAM Image Viewer program to view the *.jmf files.

Folder	Num	Folder	Num
12-22	16	12-12	1
12-11	1	12-09	1
11-29	1	11-25	7
11-24	4	11-21	3
11-19	1	11-14	1
11-07	2		

Figure #68

Toolbar Button	Alternative Soft Key	Function
		Tap to select the next folder displayed on the screen.
		Tap to select the previous folder displayed on the screen.
		Tap to change the brightness of the LCD Backlight (page 17).
		Tap to load the image/still file.

Loading the Motion Clip / Still Image File

Figure #69(A) shows a preview of a *.jmf file. To playback the motion clip, it must be loaded. Tap  or press the  soft key to load the motion clip. Figure #69(B) shows an example of the screen that will be displayed.

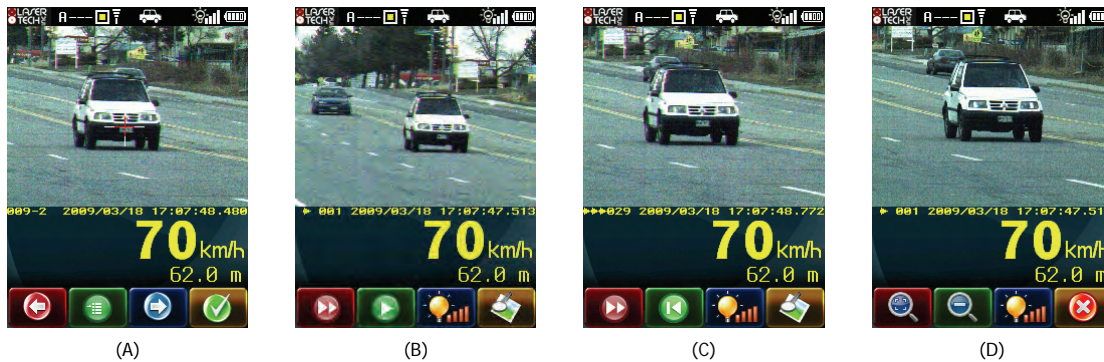






























Figure #69

Toolbar Button	Alternative Soft Key	Function
		Tap to preview previous *.jmf file.
		Tap to display the list of folders stored on the SD Card.
		Tap to preview next *.jmf file.
		While the image is being previewed, tap to load the *.jmf file. While the still image is loaded, tap to return to Playback Mode.
		Tap to advance one frame of the motion clip.
		Tap to playback the motion clip. As the motion clip is played, the frame number is updated. The Single triangle and triple triangle show playback speed. Single is normal and triple is fast play during tracking. In Figure #69(C), the  that appears to the left of the date and time represents 240 image size and has a total of 29 frames. ( = 480 image size and has a total of 35 frames). During motion clip playback, the crosshair indicator displays at the time and location on the target when the laser measurement was taken. During DBC playback, the crosshair indicator displays twice, noting the measurement time and target location for each individual laser measurement during the DBC process.
		This button is displayed while the image is being played back. Tap to stop the motion clip playback.
		Tap to reload the motion clip.
		Tap to change the brightness of the LCD Backlight (page 17).
		Tap to load the still image.
		Tap to enlarge detail of the displayed image.
		Tap to restore normal display.
		Tap to return to Preview Mode.

Exiting Playback Mode

There are three ways to exit Playback Mode: [1] Pull the TRIGGER to start the Capture Mode. The Speed Capture Screen will be displayed (page 35). [2] Quickly press and release the Power Button two times. The System Setup Screen will be displayed (page 19). [3] Double-tap the Battery Icon located in the upper right corner of the LCD Touch Screen. The System Setup Screen will be displayed (page 19).

Section #7 - Instrument Tests & Confidence Checks

LTI recommends the following tests be performed by an operator before or after each shift to confirm proper instrument operation. The combination of operator-performed daily checks and built-in instrument self tests provide positive indication of a system fault, should one occur.

Self Test

When the TruCAM is powered ON, a number of internal checks are performed. During those tests all display segments are lit and a series of tones are emitted. When all of the tests have successfully completed, the Self Test Results Screen is displayed briefly before the instrument is ready for use. If any test fails, a system error message is displayed and the instrument will not operate. See page 18 or 24 for information about Self Test results.

HUD Integrity Test

LTI recommends that you perform this test before or after each shift to verify that all in-scope display segments are operating properly.

At power ON, compare the instrument's in-scope Heads Up Display to Figure #70. The lower portion of the display flashes 2 times and the aiming reticle is illuminated. If the display times out before you can complete this test, you will need to power OFF the TruCAM and repeat this step.

- ❗ If any segment fails to display, contact LTI or an LTI authorized service center to arrange for repair. See the inside front cover for LTI contact information.



Figure #70

Scope Alignment Test



LTI recommends that you perform this test before or after each shift to verify proper alignment of the aiming reticle to the laser measurement beam.




Scope alignment is set at the factory when the instrument is shipped. A heavy blow is the only reason that the aiming reticle might ever go out of alignment. The Scope Alignment Test uses sound to indicate when the scope is on-target with the laser measurement beam.

- ❗ When the scope is properly aligned and you are targeting close targets, you will see a small vertical offset due to the separation between the optics of the sighting scope and the laser transmitter. Therefore, you should choose a target that is at the longest possible distance when performing the Scope Alignment Test. A target at a distance of 200 meters (650 feet) or greater is preferred if available.



Figure #71

1. Select a target. Choose a prominent target with well-defined horizontal and vertical edges. A telephone pole is an excellent choice.
 - The target's reflective qualities and distance should be such that you can clearly hear a change in pitch of the test tone as you pan the instrument over the edges of the target.
 - Make sure there is nothing behind the target that the instrument might detect, so you know without a doubt that any change in pitch is due strictly to the target.
2. Ensure that the TruCAM is powered ON.
3. From the System Setup Screen, tap  or press the  soft key to activate the Test Tone display screen. It should look similar to Figure #71.
4. Scan the target. Press and hold the TRIGGER while panning the instrument across the target. The tone changes pitch when the instrument acquires the target. The highest pitch - the on-target tone - should occur when the in-scope aiming reticle is centered on the target. Scan the target both horizontally and vertically to confirm alignment in both directions.
 - If the test tone pitch decreases evenly off of each side of the target, adjustment is not needed.
 - The TruCAM counts the number of TRIGGER presses that are made during the Scope Alignment Test.

After 5 TRIGGER presses,  is displayed in the toolbar. Tap  or press the  soft key to save the date and time of the last Scope Alignment Test which is displayed on the Device Information Screen (page 24).
 - If there is a discrepancy between the on-target tone and the position of the aiming reticle, remove the TruCAM from use and contact LTI or an LTI authorized service center to arrange for repair. See the inside front cover for LTI contact information.

Camera Alignment Test

LTI recommends that you perform this test before or after each shift to verify that the video crosshair displayed on the screen matches the position of the aiming reticle.

The video crosshair displayed on the screen is set at the factory when the instrument is shipped. A heavy blow is the only reason that the camera and crosshair position might ever go out of alignment.

- ❗ Always perform the Scope Alignment Test (previous page) before doing the Camera Alignment Test.
 1. Aim to the target that was used for the Scope Alignment Test and pull the TRIGGER to activate the Speed Measurement Mode.
Reminder: The recommended distance to target is 200 meters minimum (650 feet).
 2. Position the aiming reticle on the target and take a measurement.
 3. Immediately view the position of the video crosshair on the display and make sure that it is aimed in the same location as the aiming reticle.
 - If the video crosshair is in proper alignment, adjustment is not needed. As an example, refer to Figure #72.
 - If the video crosshair is not in proper alignment, remove the TruCAM from use and contact LTI or an LTI authorized service center to arrange for repair. See the inside front cover for LTI contact information.

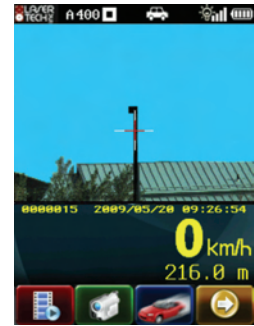


Figure #72

Instrument Confidence Checks

There are several ways to verify the measurement accuracy of a Lidar instrument. You can verify it directly by measuring the speed of an object traveling at a known speed, but this is seldom practical. The nature of Lidar is such that it cannot be tricked by a vibrating object, such as a tuning fork, into displaying a velocity. For these reasons, LTI has designed the Fixed Distance Zero Velocity Test and the Delta Distance Test. LTI suggests that you do one of these tests each time the instrument is taken on duty.

These tests verify the accuracy of the two key elements of Lidar speed measurement:

- Precise time measurements
- Ability to make mathematical calculations

When setting up an area for these tests, LTI recommends:

- Permanently installing the test area in a convenient location. The test area must establish a permanent, known distance between a shooting mark and a target (Fixed Distance Zero Velocity Test) or between a shooting mark and two targets (Delta Distance Test).
- Using a metal tape to measure the distance; this will ensure that the measurement is accurate.

Other considerations:

- The shooting mark is where you stand to do the test, and it can be an "X" painted on the pavement.
- A target can be any flat, permanent structure — a sign or wall, for example, painted with a bull's eye or other aiming point.
- The shooting mark and the target must form a straight line.
- The manner in which you stand and hold the instrument both affect the test measurements. For exact readings, carefully hold the instrument so the center of the TruCAM is directly over the middle of the X.

Fixed Distance Zero Velocity Test

LTI recommends that you perform this test before or after each shift.

i In order to perform the Fixed Distance Zero Velocity Test, the Speed Mode must be active.

The Fixed Distance Zero Velocity Test requires one target. When selecting the target, keep in mind that the distance to the target must be greater than the minimum distance of the TruCAM. The typical minimum distance is 15 meters (50 feet). To simplify the interpretation of the test results, LTI recommends that the distance between the target and the shooting mark be a multiple of 1 meter (or 1 foot), not a fraction of a meter (or foot).

1. Stand on the shooting mark.
2. Ensure the TruCAM is powered ON and that the Speed Mode is active.
3. Aim to the target and pull the TRIGGER.
4. Check the display. The speed reading should be zero km/h (or 0 MPH) as Figure #74 shows. A reading of zero verifies the timing accuracy of the instrument and is identical in nature to an accurate velocity reading of a vehicle moving at any speed.

Example:

- If the fixed distance was 60 meters:
an acceptable displayed distance result = from 59.8 to 60.2 meters.
 - Distance accuracy = ± 15 cm or 0.2 meters (rounded).
 - Speed accuracy = ± 2 km/h.
- If the fixed distance was 175 feet:
an acceptable displayed distance result = from 174 to 175 feet.
 - Distance accuracy = ± 6 inches.
 - Speed accuracy = ± 1 MPH.
- If you need assistance, contact LTI. See the inside front cover for LTI contact information.

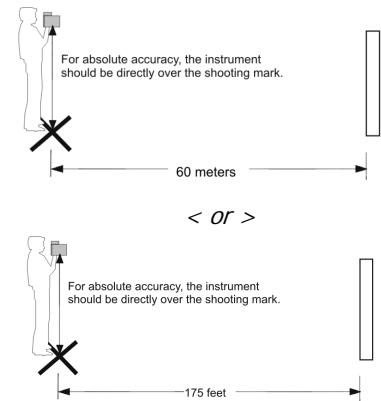


Figure #73



Figure #74

Delta Distance Test

- i** This test is optional. Your TruCAM may not include the Delta Distance Test.
It is a factory-defined option that is set when the instrument is shipped.

The Delta Distance Test is optional and requires two targets. When selecting the targets, keep in mind that the distance to the targets must be greater than the minimum distance of the TruCAM. The typical minimum distance is 15 meters (50 feet).

To simplify the interpretation of the test results, LTI recommends that the distance between the targets and the shooting mark be a multiple of 1 meter (or 1 foot), not a fraction of a meter (or foot).

Example: Positioning the Targets and the Shooting Mark

1. Install the farther target.
2. Measure 55 meters (175 feet) to the shooting mark and mark the shooting spot.
3. Measure from the shooting mark 45 meters (150 feet) to the second target.
4. Mark that spot and install that target.

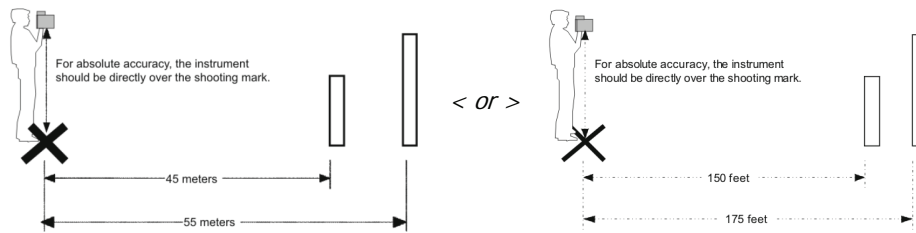


Figure #75

Conducting the Test

1. Stand on the shooting mark.
2. Power ON the TruCAM and tap or press the soft key to display the Test Tone/Scope Alignment Screen.
3. Tap or press the soft key to display the Delta Distance Test Screen. The screen will be prompting you to shoot to the first target as shown in Figure #76(A). The Red Toolbar button and soft key will not be active until you complete the first measurement.
4. Aim to the far target and pull the TRIGGER.
5. Check the display. As Figure #76(B) shows, the measured distance will be displayed. If necessary, you may repeat step #4.
6. Tap or press the soft key to display the next screen. The screen will be prompting you to shoot to the second target as shown in Figure #76(C). The Red Toolbar button and soft key will not be active until you complete the second measurement.
7. Aim to the near target and pull the TRIGGER.
8. Check the display. As Figure #76(D) shows, the measured distance will be displayed. If necessary, you may repeat step #7.
9. Tap or press the soft key to display the results screen as shown in Figure #76(E).
 - o **Meters:** The screen displays the difference between the two distances 10 meters \pm 30 cm.
 - o **Feet:** The screen displays the difference between the two distances 25 feet \pm 6 inches.
 - o The result appears as a positive number if the targets are shot in reverse order (near target first and the far target second).

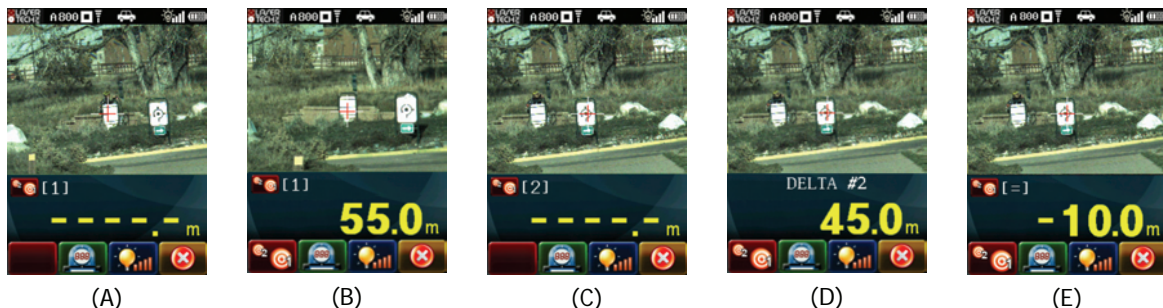


Figure #76

Section #8 - Care and Maintenance

Operating Temperature

The TruCAM is rated for a temperature range of -10° C to +60° C (+14° F to +140° F). Do not operate the instrument in temperatures outside that range.

- ❗ When in storage, the TruCAM is rated for a temperature range of -20° C to +60° C (-4° F to +140° F). Do not store the instrument in temperatures outside that range.

Moisture and Dust Protection

The TruCAM is sealed to provide protection from normally encountered field conditions. It is protected from dust and light moisture.

Shock Protection

The TruCAM is a precision instrument and should be handled with care. It will withstand a reasonable drop shock. If you drop the instrument, check the scope alignment (page 45) and camera alignment (page 46) before using the instrument for speed measurement / video image capture.


Transporting

Use the provided carrying case when transporting the TruCAM. This is especially important when transporting the instrument in a vehicle since sudden bumps or sharp cornering might damage the instrument.

Cleaning and Storage

Clean the instrument after each use. Check for the following:

- *Excess moisture.* Towel off excess moisture and air dry the instrument at room temperature.
- *Exterior dirt.* Wipe exterior surfaces clean.
 - *LCD Touch Screen.* Use a soft cloth to wipe the screen. Do not use any liquid cleaners.



To reduce the risk of damage to the internal components, do not spray liquid directly on the screen or allow excess liquid to drip into your TruCAM. Using soap or other cleaning products on the screen might discolor the finish and damage the screen.
 - *Scope Exterior.* Use isopropyl alcohol to remove dirt and fingerprints.
 - *Lenses.* Use a lens brush to remove surface dust and loose particles from the front panel lenses. To clean a lens, moisten it with lens cleaning solution and wipe it with a clean cloth or lens tissue.
- *Battery Pack* If you won't be using the instrument again soon, remove the Battery Pack before storing it.

Caring for the Scope

Do not attempt to lubricate the scope. It is sealed from within using o-rings and special compounds. All seals are permanent and require no maintenance.

Use a lens brush to remove surface dust and loose particles. To clean a lens, moisten it with lens cleaning solution and wipe it with a clean cloth or lens tissue.



Caring for the LCD Touch Screen



To prevent damage to the LCD Touch Screen, never use any device other than the stylus that comes with the TruCAM to tap on the LCD Touch Screen. If your stylus is lost or broken, please contact LTI to order replacement stylus. See the inside front cover for LTI contact information.

Realigning the LCD Touch Screen

If the TruCAM does not properly respond to your taps, the LCD Touch Screen may need to be realigned. The "Align Screen" option is available on the Device Parameters Screen (page 25).

- ❗ While the Calibration Screens are displayed, the Toolbar buttons are not active.

Do not tap  or . The soft keys located on the rear panel are active while the Calibration Screens are displayed:

- Press the  button to adjust the LCD Brightness Level.
- Press the  button to cancel the realignment process and return to the System Setup Screen without realigning the Touch Screen.

1. Display the Device Parameters Screen.
2. Use the stylus to tap the area indicated on the screen to "Proceed" and Align the screen. (A) (A) shows the first Calibration Screen, it will prompt you to tap the screen.
3. Tap the target black box located in the upper left corner of the screen. (B) shows the second Calibration Screen.
4. Tap the target black box in the lower right corner of the screen. (C) shows the third Calibration Screen.
5. Tap the target black box in center of the screen.
 - If the process is successful, the data will automatically be saved and the System Setup Screen will be displayed.
 - If the process is not successful, a message will be displayed prompting you to "Please try again" as shown in (D). Start with Step #3 above.

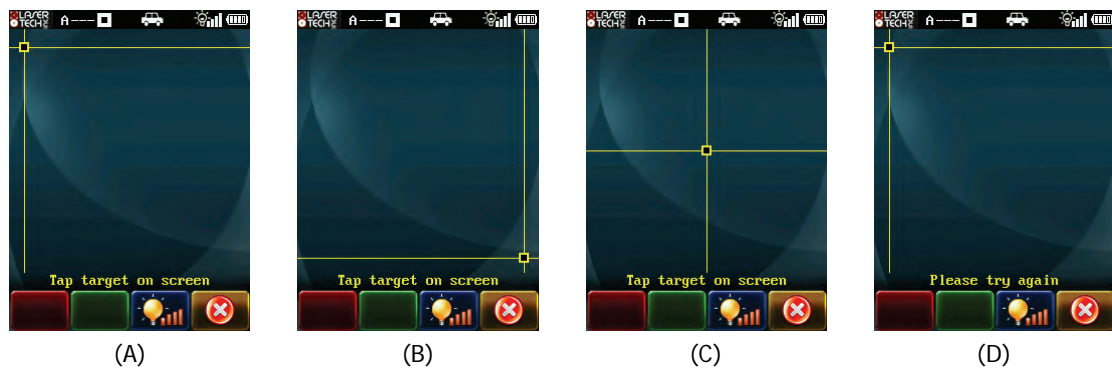


Figure #77

Restoring Factory Default Settings

1. Use the stylus to double-tap "Reset...". shows the message box that will be displayed.
2. Use the stylus to enter the user password. As shown, the TruCAM Splash Screen will be displayed while parameters are reset. Once all parameters are reset, the TruCAM will power OFF.

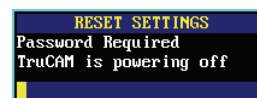


Figure #78



- Tap  or press the  soft key to cancel without resetting the parameters. The Device Parameters screen will be displayed.



Figure #79

Parameter	Factory Default Value	Page #
AGC	enabled	30
Backlight Timer	120 seconds	25
Camera Power	60 seconds	25
Capture Speed	0	19
Crosshair	Classic	22
Date Format	YYYY/MM/DD	26
Frame Rate	24 frames/second	26
GPS Interval	60 seconds	26
HUD brightness	6	13
Language Selection	English	21
LCD Backlight Level	level 3	17
Location	S Tucson Way	19
Operator ID	23456	19
Operator Name	LaserTech	19
Power OFF Timer	600 seconds	25
Roadside Offset	5.0 meters (16.4 feet)	Roadside Offset38
Shutter Speed	1/800 second	31
Speed Limit	0	19
Track Storage	8	26
Unmanned Distance	70 meters (229 feet)	22
Unmanned Mode	disabled (= Manned Mode enabled)	22
User Password	admin	27
Video Mode	1920 x1440 , 240 x180	19
Video Tracking Distance & Mode	70 meters (229 feet) Enabled	19
White Balance_blue	1024	32
White Balance_intensity	128	32
White Balance_red	1024	32

Section #9 - TruCAM Image Viewer

The TruCAM Image Viewer software runs on the Office PC and is used to:

- Transfer motion clips (*.jmf files) from the SD Card to the Office PC.
- Play motion clips and view still images.
- Create *.avi format of a motion clip. The *.avi files can be viewed using a program such as Microsoft Windows® Media Player.
- Create *.jpg format of a still image.
- Create a *.jpg format of a single frame of a motion clip.
- Create and manage Predefined Lists for Operator Names and Locations used on the TruCAM System Setup Screen.
- Print images.
- Select the language used for text display in both the TruCAM and the TruCAM Image Viewer program.
- Check/repair the SD Card.

PC Requirements:

- Operating System: Microsoft Windows® 2000, Microsoft Windows® XP or Microsoft Windows® Vista
- CD ROM Drive
- USB Port

Installing the TruCAM Image Viewer Software

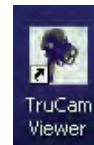
1. Insert the TruCAM Image Viewer Software CD in the PC's CD-ROM drive. The TruCAM Image Viewer Installation Wizard will be displayed.
 - If Auto Play is not enabled on your PC, select Start > Run.
 - Enter X:\setup.exe. Where X is the letter of your CD-ROM drive.
 - Click the [ok] button. Setup will be initialized and the Installation Wizard will be displayed.
2. To complete the installation, follow the instructions displayed in the wizard. A progress bar will be displayed as the software is installed.
3. Click the [Finish] button to close the wizard once the installation is complete.

Starting the TruCAM Image Viewer Program

If you accepted the default location during the installation process, the software was installed at the following location:

C:\Program Files\LT\TruCAM Viewer\TruCAMViewer.exe

- You can start the program using the TruCAM Viewer desktop icon or from the PC's Start Menu > Programs > Laser Technology, Inc > TruCam Viewer > TruCam Viewer



After you start the program, the TruCAM Image Viewer will be displayed. It should look like Figure #80.

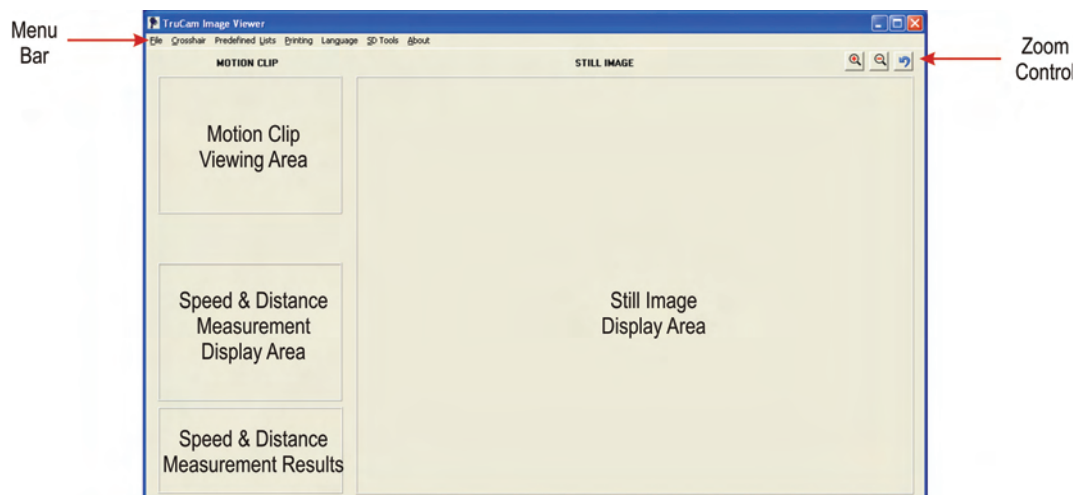




Figure #80

Using the Menu Bar

The Menu Bar includes seven pull-down menus. The table below lists the menus and the options available on each menu.

Menu	Available Options	Function
File	Open Clip	Allows you to select the *.jmf file that you want to view. First you will be prompted to select a folder (laser serial number), and then a second folder based on the date (MM_DD). Example of MM_DD is 05_04 = May 4th.
	View Details	Displays Speed and Capture Limit detail, TruCAM firmware version number, TruCAM serial number, Last Alignment, Operator ID and Name, Image Capture Date, Time and Location, and any GPS data related to the *.jmf file that is currently displayed.
	Transfer Clips from SD Card	Moves or copies the *.jmf files from the SD Card to the Office PC.
	Refresh Clips Summary	Generates or updates the Summary.log file. This log file is a text file that contains one record for each *.jmf file transferred from the SD Card to the Office PC using the TruCAM Image Viewer program. By default, log file location is C:\Program Files\LT\TruCam Viewer\.
	Browse Clips	Displays the Browse Clip Files window. This window includes the information from the Summary.log file that was generated or updated using the "Refresh Clips Summary" option (above).
	Save Still Image	Creates *.jpg format of the still image.
	Save Current Frame	Creates a *.jpg format of the frame of a motion clip that is currently displayed.
	Save Clip (Compressed)	Creates *.avi format of the selected motion clip file. The *.avi files can be viewed using a program such as Microsoft Windows® Media Player. This option generates smaller file size.
	Save Clip (Un-compressed)	Creates *.avi format of the selected motion clip file. The *.avi files can be viewed using a program such as Microsoft Windows® Media Player. This option generates larger file size.
	Exit	Closes the TruCAM Viewer program.
Crosshair	Classic	Like the TruCAM, you can toggle the crosshair between Classic  and Beam Size  (default). A check mark appears to the left of the current selection.
	Beam Size	
Predefined Lists	Manage Operator Names	Allows you to create and manage the Operator Names Lists for use on the TruCAM System Setup Screen.
	Manage Locations	Allows you to create and manage the Locations Lists for use on the TruCAM System Setup Screen.
Printing	Print	Prints two images from the *.jmf file that is currently displayed: (1) The frame that displays the crosshair to indicate the speed and distance measurement. (2) The final frame of the motion clip. Also includes the text data related to the *.jmf file. Figure #81 (next page) shows an example.
	Print Tagged	While viewing images, you can tag or select individual images that you want to print (page 56). This option allows you to print only the images that you tagged while browsing.

Menu	Available Options	Function
	Print Batch	<p>Displays the Print Selected Clip Files window that allows you to select multiple *.jmf files. Prints two images for each *.jmf file selected: (1) The frame that displays the crosshair to indicate the speed and distance measurement. (2) The final frame of the motion clip. Also includes the text data related to the *.jmf file.</p> <p>To select multiple *.jmf files:</p> <ul style="list-style-type: none"> • Select this menu and option. • Navigate to the TruCAM serial number and date. • Press and hold the Ctrl (Control) key on the keyboard and use the mouse to select the *.jmf that you want to include in the batch. • When ready to print, release the Ctrl key and click on the Print Selected button.
Language	Select TruCAM Languages	<ul style="list-style-type: none"> • Displays the languages that are available to be loaded on the SD Card. Default: allows you to select a maximum of 4 languages. • Displays the languages that are currently loaded on a particular SD Card.
	Select Viewer Languages	<ul style="list-style-type: none"> • Displays the current language displayed in the TruCAM Image Viewer program. • Allows you to change the language displayed in the TruCAM Image Viewer program.
SD Tools	Check & Repair	Checks the integrity of the SD Card file system. Repairs the SD Card file system if a problem is found.
About	N/A	Displays the TruCAM Image Viewer Software version number and copyright information. Tap the OK button to close the About Screen.



Figure #81

Transferring the *.jmf Files from the SD Card to the Office PC

Each *.jmf file includes the motion clip, still image, and all associated text data. The number of files that can be saved on each SD card depends upon the SD card size, the image size selected and the length of video captured for each file. For a 4 GB SD card, the average is approximately 2,000 files stored. TruCAM Image Viewer makes it easy to transfer the *.jmf files from the SD Card to the Office PC. During the transfer process, you will be prompted to delete clips from the SD Card (Figure #82).



Figure #82

1. Remove the SD Card from the TruCAM.
2. Insert the SD Card into the SD Card Reader and then insert the SD Card Reader into an available USB port on the Office PC.
3. In TruCAM Image Viewer select File > Transfer Clips from SD Card.
 - Click on the answer to this question: Delete Clips from SD Card?
 - If you receive an error message that the SD Card is not found, just clear the error message and a window will be displayed, prompting you to navigate to the SD Card. Example Location: My Computer > Removable Disk > TruCAM > film
 - If you click the [Yes] button, the files will be moved from the SD Card to the Office PC. The files will no longer reside on the SD Card.
 - If you click the [No] button, the files will be copied from the SD Card to the Office PC. The files continue to reside on the SD Card.
 - As Figure #83 shows, a progress bar will be displayed. Click the Cancel button if you want to stop the transfer process.
 - When the transfer process is complete, a message box will be displayed as Figure #84 shows.
4. Click the OK button to clear the message.



Figure #83



Figure #84

Browsing the *.jmf Files

1. Transfer the *.jmf files from the SD Card to the Office PC (see above).
2. Select the File Menu > the Refresh Clips Summary option. An hourglass may be displayed during this process.
3. Select the File Menu > Browse Clips option. The Browse Clip Files window will be displayed (Figure #85). Initially, the left display window includes a folder icon titled "Movie Clips" and the right display window is blank.
4. Use the mouse to click on the "+" symbol to the right of the folder icon. You will be prompted to select the TruCAM serial number > image capture date > *.jmf that you wish to view.
5. Select the View button to display the selected *.jmf file.
 - Select the Close button to close the window without viewing a *.jmf file.

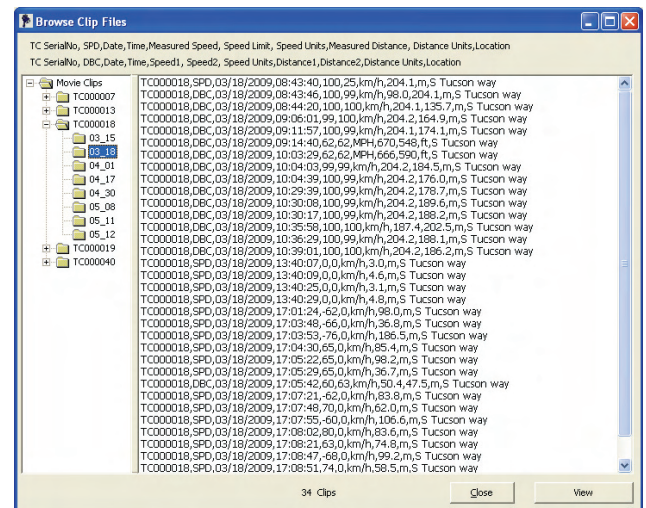


Figure #85

- ❗ To open one particular *.jmf file:
1. Select the File Menu and then the Open Clip option.
 2. Select the folder that corresponds to the TruCAM serial number.
 3. Select the folder that corresponds with the date that you want to view.
 4. Select the file that you want to view.
 5. Click the Open button (or double click in step 4).

If your files are not stored in the default location, select the File Menu > Open Clip option and then manually navigate to locate the *.jmf file that you want to open.

Figure #86 shows an example of a *.jmf file displayed in TruCAM Image Viewer.

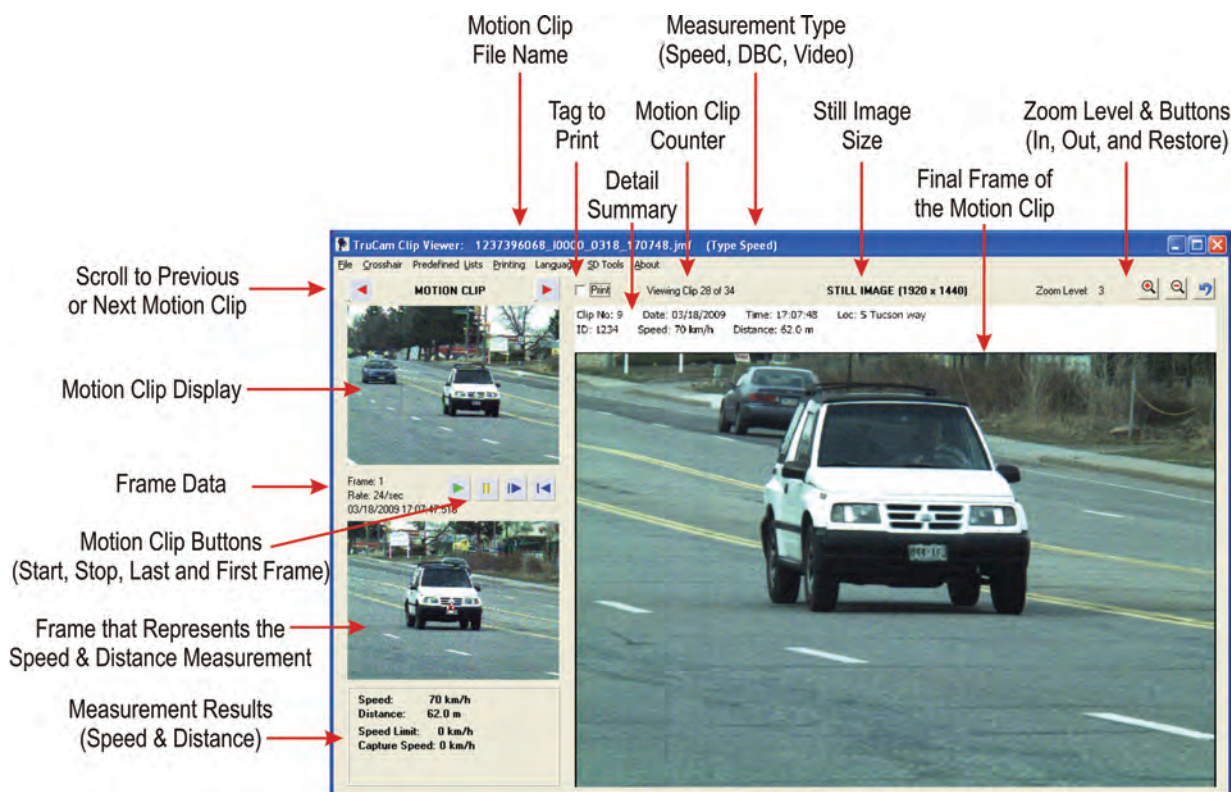




Figure #86

- To scroll to the next *.jmf file, select the  at the top of the MOTION CLIP display area.
- To scroll to the previous *.jmf file, select the  above the MOTION CLIP display area.
 - As you scroll through the *.jmf files, the images, Detail Summary, Motion Clip Counter, Still Image Size, Frame Data, and Measurement Results will update.
 - The crosshair indicator displays at the time and location on the target when the laser measurement was taken. During DBC playback, the crosshair indicator displays twice, noting the measurement time and target location for each individual laser measurement during the DBC process.
- To view the more detail information related to the *.jmf file, select File > View Details. Figure #87 shows an example. You may see additional data, depending upon the features of your TruCAM, capture mode, etc.
- To tag this image to print later, use the mouse to click on the box that appears to the left of the "Print", the Tag to Print option shown in Figure #86. When ready to print all tagged images, select the Printing menu > Print Tagged option. For information about printing, see pages 53-54.

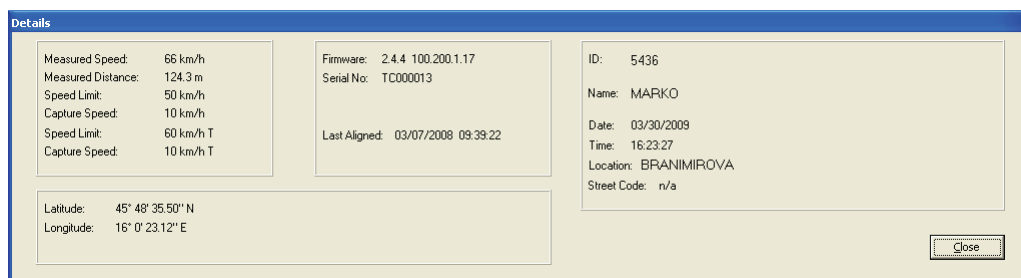


Figure #87

Playing a Motion Clip

The Motion Clip Control buttons are available whenever the displayed *.jmf file includes motion frame data.

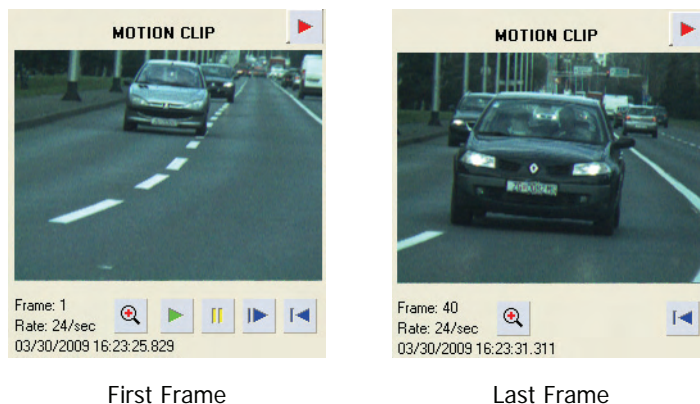







Figure #88

-  Select to display the Large Clip Viewer window.
-  Select to play the motion clip.
-  Select to stop the motion clip.
-  Select to advance to the next frame of the motion clip.
-  Select to return to the first frame of the motion clip.

Managing Predefined Lists

The Predefined Lists option allows you to create and manage the Operator Names and Locations Lists that are used on the TruCAM System Setup Screen (page 19). Predefined lists do require setup/maintenance time, but offer time savings during the roadside setup process.

- *If a predefined list is not used*, the operator uses the stylus and on-screen keypad to enter the required alpha-numeric characters for both the "Operator Name" (49 characters max) and the "Location" (59 characters max).
- *If a predefined list is used*, the operator uses the stylus and on-screen keypad to scroll to and select the desired Operator Name or Location from the predefined list.
 - If the desired Operator Name or Location is not found on the predefined list, the operator can manually enter the Operator Name or Location.
- See page 58 for information about the Operator Names List.
- See page 59 for information about the Locations List.

Operator Names List

When you select Predefined Lists > Manage Operator Names, you should see a window that looks similar to Figure #89.

The Menu Bar on the Operator Names Manager window includes 3 menus. The table below lists the menus and the options available on each menu.

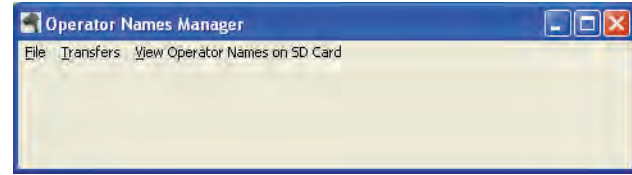


Figure #89

Menu	Available Options	Function
File	New	Creates a new Operator Names list. You will be prompted to enter the ID and Operator Name for each entry. <ul style="list-style-type: none"> Type the desired information and use the Tab key to move to the next field. When done, review the accuracy of the entries and make any necessary corrections. Save the list (see below).
	Open	Opens an Operators Names list that exists on the Office PC. <ul style="list-style-type: none"> You will be prompted to select the file that you want to open and then select the Open button. You may add new entries or edit existing entries. When done, review the accuracy of the entries and make any necessary corrections. Save the list (see below).
	Save	Prompts you to name the file that you want to save. <ul style="list-style-type: none"> New file: Type the file name and then select the Save button. Existing file: Select the file and then select the Save button. Assigned file type = *.pbe File Location = TruCAM Viewer\predef_names\
	Exit	Closes the Operator Names Manager window.
Transfers	To SD Card	SD Card must be in the SD Card Reader and the SD Card Reader must be inserted in one of the Office PC's USB ports. <ul style="list-style-type: none"> The Select File Names window will prompt you to select the Operator Names list that you want to transfer to the SD Card. When the transfer process is complete, a message box will be displayed. Click the OK button to clear this message.
	From SD Card	SD Card must be in the SD Card Reader and the SD Card Reader must be inserted in one of the Office PC's USB ports. <ul style="list-style-type: none"> The Select File Names window will prompt you to select the Operator Names list that you want to transfer to the Office PC. When the transfer process is complete, a message box will be displayed. Click the OK button to clear this message.
View Operator Names on SD Card	N/A	SD Card must be in the SD Card Reader and the SD Card Reader must be inserted in one of the Office PC's USB ports. Displays the Operator Names list that is currently active on the SD Card.

Locations List

When you select Predefined Lists > Manage Locations, you should see a window that looks similar to Figure #90.

The Menu Bar on the Location Manager window includes 3 menus. The table below lists the menus and the options available on each menu.

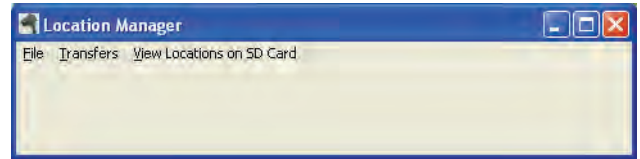


Figure #90

Menu	Available Options	Function
File	New	Creates a new Locations list. You will be prompted to enter the ID and Operator Name for each entry. <ul style="list-style-type: none"> Type the desired information and use the Tab key to move to the next field. When done, review the accuracy of the entries and make any necessary corrections. Save the list (see below).
	Open	Opens a Locations list that exists on the Office PC. <ul style="list-style-type: none"> You will be prompted to select the file that you want to open and then select the Open button. You may add new entries or edit existing entries. When done, review the accuracy of the entries and make any necessary corrections. Save the list (see below).
	Save	Prompts you to name the file that you want to save. <ul style="list-style-type: none"> New file: Type the file name and then select the Save button. Existing file: Select the file and then select the Save button. Assigned file type = *.pbe File Location = TruCAM Viewer\predef_addresses\
	Exit	Closes the Locations Manager window.
Transfers	To SD Card	SD Card must be in the SD Card Reader and the SD Card Reader must be inserted in one of the Office PC's USB ports. <ul style="list-style-type: none"> The Select File Names window will prompt you to select the Locations list that you want to transfer to the SD Card. When the transfer process is complete, a message box will be displayed. Click the OK button to clear this message.
	From SD Card	SD Card must be in the SD Card Reader and the SD Card Reader must be inserted in one of the Office PC's USB ports. <ul style="list-style-type: none"> The Select File Names window will prompt you to select the Locations list that you want to transfer to the Office PC. When the transfer process is complete, a message box will be displayed. Click the OK button to clear this message.
View Locations on SD Card	N/A	SD Card must be in the SD Card Reader and the SD Card Reader must be inserted in one of the Office PC's USB ports. Displays the Locations list that is currently active on the SD Card.


Selecting Languages

The Language menu includes two options:

- Select TruCAM Languages
- Select Viewer Languages

TruCAM Languages

This option allows you to view and change the language the is used to display text on the TruCAM.

1. Remove the SD Card from the TruCAM and insert it into the SD Card Reader and then insert the reader in an available USB slot on the Office PC.
2. Select Language > Select TruCAM Languages option. The Select TruCAM Languages window will be displayed and should look similar to Figure #91(A).
 - The left portion of this window lists the languages that are available for use on the TruCAM.
 - The available languages are subject to change. Contact your authorized LTI Dealer for current language availability.
3. Select the View SD Card button. As Figure #91(B) shows, the right portion of the screen displays the languages that are on the SD Card. Maximum of 4 languages.
4. In the left window, select the language that you want to load and then select the  button. The right window should include the language that you selected.
 - An error message will be displayed if you attempt to load a 5th language. Clear the error message and then delete one of the existing languages to make space for the new language.
 - To delete a language from the SD Card, use the mouse to select the language that you want to delete and then select the X button.
5. Select the Close button to close the window.

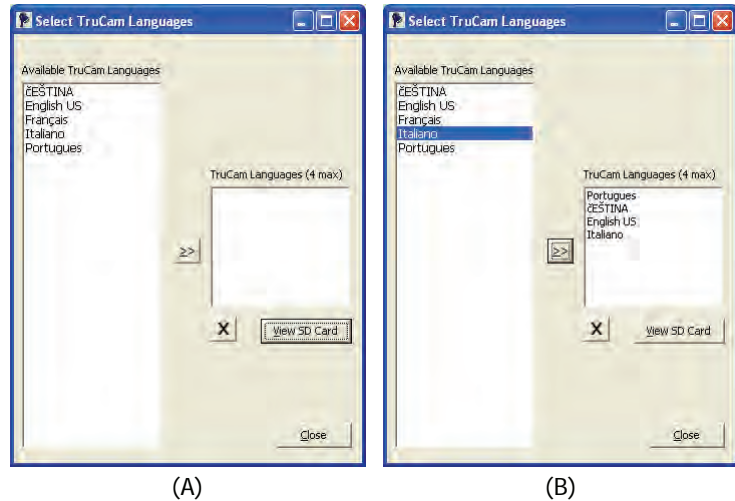


Figure #91

TruCAM Image Viewer Languages

This option allows you to view and change the language that is used to display text in the TruCAM Image Viewer program.



1. Select Language > Select Viewer Language option. The Select Viewer Language window will be displayed and should look similar to Figure #92.
 - The current language is listed at the top of the screen and the available languages are listed below.
 - The available languages is subject to change. Contact your authorized LTI Dealer for current language availability.
2. Select the available language that you want display.
3. Select the Apply button. The change will happen instantly.
4. Select the Close button to close the window.







Figure #92

Section #10 - Troubleshooting Tips

If you have a problem with your TruCAM, use the table below to troubleshoot the problem. Additional troubleshooting tips may be available on the LTI web site. If you are experiencing a problem that is not listed here or if you need assistance resolving a problem, please contact LTI or your authorized LTI Dealer for assistance. See inside front cover for LTI contact information.

Problem	Remedy
The LED Charge Indicator is not lit during the charging process.	<ol style="list-style-type: none"> 1. The battery charge is too low. Leave the TruCAM plugged in for at least one hour to trickle charge the cells. 2. After one hour, disconnect and reconnect the charging cable. 3. If enough charge is present, the LED Charge Indicator should be orange (page 10).
When I powered ON the TruCAM, it displayed an error message.	<p>Try 2 or 3 measurements, it may be automatically cleared. If it is not cleared:</p> <ol style="list-style-type: none"> a. Power OFF the TruCAM. b. Remove and re-insert the Battery Pack. c. Power on the TruCAM one more time to repeat the Self Test. d. If the error repeats, contact your Authorized LTI Dealer or LTI for assistance. See inside front cover for LTI contact information.
The TruCAM is powered ON and is not responding to any taps or button presses.	<ol style="list-style-type: none"> 1. Remove and then re-insert the battery pack. <p>Press the Power Button or pull the TRIGGER to power ON the TruCAM.</p>
The TruCAM is not responding properly to taps and double-taps.	<p>The LCD Touch Screen needs to re-aligned.</p> <ol style="list-style-type: none"> 1. Access the Device Parameters Screen. 2. Select or double-tap the Align Screen "Proceed" option. 3. Follow the prompts to re-align the screen.
I changed the time zone on the System Setup Screen, but the Date & Time was not updated.	<p>The change is not immediately displayed. The Date & Time is only updated when the GPS has a fix. In most cases you will have to be outside and cycle the TruCAM OFF</p>
On the Device Information Screen, the Last Alignment Check displays an incorrect date.	<p>The Last Alignment Check is only updated after you have a completed a minimum of 5 test tones. You may have completed less than 5 test tones. Repeat the Scope Alignment Test (page 45)</p> <p>and remember to tap  or press  to save the test results before exiting the screen.</p>
The various Power OFF intervals are inconvenient, either too short or too long. When intervals are too long, it drains the battery charge.	<p>The default values associated with the various Power OFF intervals are designed for battery life. The Power OFF intervals can be extended or shortened on the Device Parameters Screen (page 25).</p>
I want to increase the on-time of the GPS.	<p>Set the GPS interval to 0 to prevent the GPS from powering OFF (page 26). Note: the continual on-time will shorten battery life.</p>
Previously changed the user password, and have forgotten what it is.	<p>Contact your Authorized LTI Dealer or LTI for assistance. See inside front cover for LTI contact information.</p>
Date and/or time is incorrect.	<p>Update on the System Setup Screen (page 19).</p>
During the Manned Auto Mode, only still images are produced, video clips are not produced.	<p>If you require video clips, select the Unmanned Auto Mode.</p>

Problem	Remedy
Difficult to see the LCD Touch Screen.	<ul style="list-style-type: none"> • Tap  to adjust the intensity of the LCD Backlight. • Attach the Sun Shade. • Change your location in relation to the sun.
The TruCAM is powered ON, but do not know how to start the Speed Mode.	Pull the TRIGGER.
The in-scope aiming reticle is not visible.	<ol style="list-style-type: none"> 1. Pull the TRIGGER to activate the aiming reticle. 2. Tap  to increase the intensity of the aiming reticle. 3. Adjust the polarizing filter.
Measurement Error: Unstable Targeting.	Attach the Shoulder Stock (page 32) or mount the TruCAM on a tripod.
Erroneous speed measurements / not repeatable.	<ul style="list-style-type: none"> • Do you have a clear line of sight? • Check the scope alignment. • Is it raining or foggy. If yes, is the Weather Mode active? If not, turn it ON. Keep in mind that the minimum range will be 61 meters. • When measuring a short range to a small target, aim slightly above the target.
Limited range.	<ul style="list-style-type: none"> • Do you have a clear line of sight? • Rain or fog will reduce the unit's maximum range. • Is the Weather Mode active? If not, turn it ON. Keep in mind that the minimum range will be 61 meters. • Keep in mind that acquiring a target through glass will reduce the unit's maximum range. • Make sure the Transmit and Receive Lenses are clean. • Check the Transmit and Receive Lenses for scratches.
Images are fuzzy.	Keep in mind that the optimum targeting distance is 70 meters (230 feet). Hand-held: 15 - 80 meters (50 - 262 feet). Tripod mounted: 15 - 90 meters (50 - 295 feet). You may need to adjust the Video Tracking Distance (page 19), Auto Mode Camera Lens Focus Distance (page 22) or Camera settings (page 30).
Difficulty acquiring target while aiming through rain or snow.	Is the Weather Mode active? If not, turn it ON. If not, turn it ON. Keep in mind that the minimum range is 61 meters (200 feet). It may be necessary to adjust the Video Tracking Distance (page 19), Auto Mode Camera Lens Focus Distance (page 22), or Camera settings (page 30).

Problem	Remedy
Images are too dark.	<p>Shutter speed → F-number → AGC <i><optional></i> → brightness level <i><optional></i></p> <ol style="list-style-type: none"> Try to set slower shutter speed, like 600, 400 or 800 instead of 1K0 or 1K5. <ol style="list-style-type: none"> If it is still dark, you may open the aperture a little bit, however do not open too much. Always maintain bigger F-number. Examples: F-number should be 8 to 11 for cloudy and foggy, and 11 to 16 for sunny day. Adjust your location so the sun is on your back and behind the Camera and illuminates the license plate. <i><optional></i> Turn on AGC (page 30). <i><optional></i> Adjust brightness level using the  button (page 32).
Images are too light.	<p>F-number → shutter speed → AGC <i><optional></i> → brightness level <i><optional></i></p> <ol style="list-style-type: none"> Try to set faster shutter speed, like 1K0 or 1K5 instead of 600, 400 or 800. <ol style="list-style-type: none"> If it is still light, you may close the aperture a little bit, however do not close too much. Always maintain bigger F-number. Examples: F-number should be 8 to 11 for cloudy and foggy, 11 to 16 for sunny day. <i><optional></i> Turn on AGC (page 30). <i><optional></i> Adjust brightness level using the  button (page 32).
<p><Message> WRITE PROTECTED Unlock SD Card Powering Off in 60 seconds</p>	<ol style="list-style-type: none"> After the TruCAM powers OFF, remove the SD Card. Slide the small plastic toggle out of the 'lock' position. <div data-bbox="1344 1150 1485 1297" data-label="Image"> </div> <p>Figure#93</p>
<p><Message> INVALID SD CARD</p>	<p>This message is displayed when you pull the TRIGGER to start image capture and your TruCAM does not recognize the SD Card as being registered. Contact you authorized LTI Dealer for assistance.</p>
<p>I connected the TruCAM to my computer using a high-speed USB 2.0 cable and the "High Speed USB" message was not displayed.</p>	<p>Verify that the TruCAM is powered ON and that both ends of the cable are connected properly.</p>
<p>Using the USB connection, it is not possible to delete files from the SD Card.</p>	<p>Using the USB connection, files on the SD Card are Read Only. In order to remove files from the SD Card, use the SD Card Reader that shipped with your TruCAM.</p>
<p>Still image/motion clip files are large. Want to be able to store more files on the SD Card.</p>	<p>For a 4 GB SD Card, the average is approximately 2,000 files stored. If you find a 4 GB SD Card stores less than that, you may want to change the Video Mode setting to 1920/240 (page 19) and also decrease the Frame Rate and Track Storage (page 26).</p>

Problem	Remedy
In Playback Mode when listing folders of motion clips/still images, not all folders are listed.	The TruCAM interface displays the most recent 28 folders. If the SD Card contains more than 28 folders, you will need to transfer files to your Office PC using the [1] SD Card reader that shipped with your TruCAM or [2] USB connection (page 15). Then you can view the motion clips/still images using the TruCAM Viewer program.
In Playback Mode when displaying folder contents, two files have the same file name.	If the Battery Pack is accidentally removed or the SD Card is rejected while a film clip is being saved, the Film Number may be not increased. The folder will have two motion clips that have the same Film Number and the first file will be damaged
I did not use the TruCAM Image Viewer program to transfer the *.jmf files to the Office PC, and now I want to use the Viewer program to open the *.jmf files.	In the TruCAM Image Viewer program, select File > Open Clip option. Then manually navigate to the folder that contains the *.jmf file that you want to view.

Section #11 - Serial Data Interface

The TruCAM serial interface uses RS-232 signal levels and data format.

Data Format

TruCAM serial data format is similar to that of the Laser Technology 20/20 TruSpeed speed detection instruments.

All data values are available at the serial port after each speed measurement.

Format Parameters

- 115200 BPS
- 1 start bit
- 8 data bits
- 1 stop bit
- no parity
- Xon/Xoff flow control

Download Instructions

The instructions below are provided for general information only. Specific steps may vary, depending upon your data collection program.

1. Connect the TruCAM to the PC, Pocket PC, etc.
2. Start the data collection program on the PC and adjust settings to match format parameters (see above).
3. Power ON the TruCAM and verify that the speed mode is active.
4. Take the desired measurement.

Requests

Firmware Version ID Request

\$ID<CR><LF>

- \$ID** The request identifier.
- <CR>** A carriage return.
- <LF>** An optional line feed character.

Instrument response:

\$ID,TSmodel-versionid,date,csum<CR><LF>

Example Version ID Messages

Request: \$ID<CR><LF>
Response: \$ID,TC100-1.16-2,NOV 26 2008,97BBB052*49DF

Serial Number Request

\$SN<CR><LF>

- \$SN** The request identifier.
- <CR>** A carriage return.
- <LF>** An optional line feed character.

Instrument's Response:

\$SN,SerialNum*csum

Example Serial Number Message

Request: \$SN<CR><LF>
Response: \$SN,TC000077*B3CA>

Initiate Measurement Request

\$GO<CR><LF>

\$GO	The request identifier.
<CR>	A carriage return.
<LF>	An optional line feed character.

Instrument's Response:

\$OK*csum

Example Serial Number Message

Request:	\$GO<CR><LF>
Response:	\$OK*0774

Stop Measurement Request

\$ST<CR><LF>

\$ST	The request identifier.
<CR>	A carriage return.
<LF>	An optional line feed character.

Instrument's Response:

\$OK*0774

Example Serial Number Message

Request:	\$ST<CR><LRF>
Response:	\$OK*0774

Print Requests

@PR,0	No print
@PR,1	Print only valid readings
@PR,2	Print valid readings and errors

Speed / Range / Date / Time Data Message Format

\$SP,Speed,Range,Sunits,Runits,date,time*csum<CR><LF>

\$SP	Message identifier.		
Speed	The speed measurement. Legal values are 000 to 322 Km/h (000 to 200 MPH). If the target was departing when the measurement was taken, the number will be preceded by a minus sign.		
Range	The range measurement. Legal Values: Metric: 000.0 to 1200.0 (unsigned). Imperial:000.0 to 4000.0 (unsigned).		
Sunits	Speed units	K = km/h	(M = MPH).
Runits	Range units	M = meters	(F = feet).
date	YYYY-MM-DD		
time	hh:mm:ss (24 hour system)		
*csum	8-bit checksum.		
<CR>	Carriage return.		
<LF>	An optional line feed character		

Example Speed/Range Message

\$SP,-18,9.4,K,M,2008-09-16,11:39:06*AA1D

Error Messages

If an error occurs, the speed and range values are replaced by an error code in the form \$Er,xx,date,time*csum, where xx is the error code. For more information about Error Codes, see page 68.

Example Error Message

\$ER,01,2009-03-26,07:34:17.979*4738

External Device Commands

The TruCAM may send messages that are designed to look for external devices such as the roadside printer, etc. All external device commands start with << or >>.

Examples:

- >>>ID
- <<AUTO,...>

❗ You can ignore these messages. To remove these messages, contact your Authorized LTI Dealer or LTI. See inside front cover for LTI contact information.

Section #12 - Additional Information

Error Conditions

Although it is rare, error conditions can occur during a measurement attempt or in the system hardware. To make sure that you never get an erroneous speed reading, the TruCAM monitors both the system hardware and the measurement. When the instrument detects an error condition, it displays an error message instead of a measurement.

Error Messages

The table below lists the possible error messages related to speed measurements. This is not a complete list, there are additional error messages that may be displayed on the LCD Touch Screen. Generally, the error messages are self explanatory. You will need to tap OK to clear the error message, correct the cause of the error and then retry the action that had caused the error message to be displayed.

Message and Explanation	Code
Measurement Error - the target was out of range or was too close.	E 01
Measurement Error - unstable targeting. Data is not stable enough to measure speed. Possible Causes: poor aiming or panning off the target.	E 03
Measurement Error - low level of interference from a light source such as a xenon headlight.	
Jam Detect - high level of interference from a light source such as a xenon headlight.	E 07
Temperature too cold. Stop operation.	E 52
Temperature too hot. Stop operation.	E 53
Calibration Errors. Please turn OFF unit and try again. If the same error is continuously repeated, please contact LTI. **	E 55 E 57 E 56 E 58
Memory failure. Please turn OFF unit and try again. If the same error is continuously repeated, please contact LTI. **	E 60
Receiver Failure. Please turn OFF unit and try again. If the same error is continuously repeated, please contact LTI. **	E 62
General System Failure. Please contact LTI. **	E 99

***See inside front cover for LTI contact information.*

RFI Considerations

The TruCAM does not display a specific error message indicating the presence of radio frequency interference (RFI). The instrument's electronics have been designed for optimum RFI immunity. If RFI is present, the instrument displays an error message. The exact code depends on the level and nature of the RFI.

















Sounds from the TruCAM


















The TruCAM emits a variety of beeps and tones during use. The sounds vary and depend on what the instrument is doing. The table to the right is a partial list of some of the sounds that you will hear.

Sound	Explanation
3 Low-Pitched and 1 High-Pitched Beeps	At Power ON.
Low-Pitched Growl	The instrument is attempting to lock onto a target for a speed measurement.
1 Low-Pitched and 2 High-Pitched Beeps	The instrument was not able to complete the intended speed measurement due to an error. An error code will be displayed to indicate the nature of the error (page 68).
High-Pitched Single Beep	The instrument successfully completed the intended speed measurement.

Icons that Appear at the Top of the TruCAM LCD Touch Screen

The icons are the images that display at the top of the LCD Touch Screen.








































Icon	Explanation
	LTI logo <ul style="list-style-type: none"> Tap to capture *.bmp image of the image that is displayed on the LCD Touch Screen.
	Automatic Gain Control (AGC). See page 30. <ul style="list-style-type: none"> Displayed: AGC is on. Not Displayed: AGC is off.
      	Shutter Speed. See page 31. <ul style="list-style-type: none"> 200: 1/200 second 400: 1/400 second 600: 1/600 second 800: 1/800 second 1K0: 1/1000 second 1K5: 1/1500 second 2K0: 1/2000 second
	Night Time Operation <ul style="list-style-type: none"> Requires LTI IR Flash. Displayed: Night Time Mode is active. Not Displayed: Night Time Mode is not active.
 	Zoom Factor (Fine Motion Clip Mode = 480 x 360 pixels) <ul style="list-style-type: none"> Yellow box indicates the Fine Motion Clip Mode. Normal + 1 zoom level. Normal display is represented by the thick white outline. Zoom display is represented by the thin white outline.
   	Zoom Factor (Coarse Motion Clip Mode = 240 x 180 pixels) <ul style="list-style-type: none"> Black box indicates the Coarse Motion Clip Mode. Normal + 3 zoom levels. Normal display is represented by the thick white outline. As the display zooms in, the white outline gets thinner.

Icon	Explanation
	GPS Information <ul style="list-style-type: none"> • Displayed: TruCAM is in the process of receiving GPS information. • Not Displayed: TruCAM is not currently in the process of receiving GPS information.
	Speed Mode Status <ul style="list-style-type: none"> • Displayed: Speed Mode is active. • Not Displayed: Speed Mode is not active.
	Distance between Cars (DBC) <ul style="list-style-type: none"> • Displayed: DBC is active. • Not Displayed: DBC Mode is not active.
	Video Only Mode <ul style="list-style-type: none"> • Displayed: Video Only Mode is active. • Not Displayed: Video Only Mode is not active.
	Rear Plate Mode <ul style="list-style-type: none"> • Displayed: Rear Plate Mode is active. • Not Displayed: Rear Plate Mode is not active.
	Auto Mode <ul style="list-style-type: none"> • Displayed: Auto Mode is active. • Not Displayed: Auto Mode is not active.
	Weather Filter <ul style="list-style-type: none"> • Displayed: Weather Filter is active. • Not Displayed: Weather Filter is not active.
    	LCD Backlight Level <ul style="list-style-type: none"> • 0 = dimmest • 1 • 2 • 3 = default • 4 = brightest
    	Approximate Battery Voltage Level <ul style="list-style-type: none"> • 4 segments lit = 75% - 100% estimated battery life. • 3 segments lit = 50% - 75% estimated battery life. • 2 segments lit = 25% - 50% estimated battery life. • 1 segment lit = 5% - 25% estimated battery life. • 0 segments lit and red 'X' = 5% or less estimated battery life. You need to replace or recharge the battery pack as soon as possible.

TruCAM Tool Bar Buttons

The toolbar is located at the bottom of the LCD Touch Screen. The table below includes the various buttons that appear on the toolbar. The color at the top of each column corresponds to the soft key located on the TruCAM's rear plate that may be used as an alternate to tapping the toolbar button.

 Some of the buttons are related to optional features. Buttons related optional features may not display on your TruCAM.

	Confirm or Select		Confirm or Select		LCD Backlight Level		Confirm or Select
	Scope Alignment Test		Clear Data		Display System Setup Screen		Playback Mode
	Delta Distance Test		HUD Intensity Level		Speed Mode		Cancel
	Previous Folder		Video Only Mode		Zoom		Save
	Playback Mode		Rear Plate Mode		Auto Mode		Display Next 3 Options on the Capture Session Toolbar
	Shutter Speed		Weather Mode		Display Next Image		Load Still Image
	Night Time Mode		Automatic Gain Control		Distance between Cars		
	Adjust White Balance		Display List of Folders				
	Previous Image		Reload Motion Clip				
	Advance 1 Frame		Next Folder				
	Zoom In		Play Motion Clip				
	Laser Measure DBC Roadside Offset		Stop Motion Clip				
			Zoom Out				
			Manually Enter DBC Roadside Offset				

Glossary

AGC	Automatic Gain Control. Optimizes picture quality at all times during the day. It increases the video signal at low light levels to make the picture brighter.
aperture	A unit of measurement that defines the size of the opening in the lens that can be adjusted to control the amount of light that reaches the digital sensor. The size of the aperture is measured in F-stop.
beam divergence	The tendency of a laser beam to expand in diameter as it moves away from the source, measured in milliradians (mrad).
Delta Distance Test	Optional Feature. Uses two measurements each to a known distance to verify the measurement accuracy of the TruCAM.
Depth of Field	DOF. Unit of measurement that represents the range of distances within an image where the focus is acceptably sharp.
F-stop	Refers to the international standard sequence of numbers that express relative aperture. F-stop is the "lens focal length" divided by the "effective aperture diameter." The smaller the F- number, the greater the amount of light that passes through the lens. Each change of F-stop halves or doubles the image brightness as you step up or down.
Fixed Distance Test	Uses one measurement to a known distance to verify the measurement accuracy of the TruCAM.
focal length	Refers to the size of the image and angle of field of view as seen by the camera through the lens.
HUD Integrity Test	Heads Up Display Integrity Test. Allows you to verify that all segments of the in-scope display and aiming reticle are operating properly (page 45).
iris	An adjustable aperture used to control the amount of light coming through the lens. The more the iris is opened, the more light it lets is and the brighter the image will be
laser	Light Amplification by Stimulated Emission of Radiation.
lidar	A device that is similar in operation to radar, but emits pulsed laser light instead of radio waves.
microcontroller	The computer processor that controls all of the functions of the TruCAM.
Receive Lens	Located on the front panel of the TruCAM, it is the bottom lens and receives the signals back from the target and then feeds the signal information to the microcontroller.
reticle	A scale located in the sighting scope that helps you aim to your target. It is visible when the TruCAM is powered ON. You may need to pull the TRIGGER to see the reticle.
Self Test	At power ON, a number of internal checks are performed. During those tests all display segments are lit and a series of tones are emitted. When all of the tests have successfully completed, the Self Test Results Screen is displayed briefly before the instrument is ready for use. If any test fails, a system error message is displayed and the instrument will not operate (page 18).
shutter speed	The length of time that the shutter remains open as the image is captured, and is very critical for image quality. Choose lower values as much as possible. The shutter speed and aperture together control the total amount of light reaching the sensor. Shutter speeds are expressed in fractions of a second.
Transmit Lens	Located on the front panel of the TruCAM, it is the top lens and transmits the infrared laser signals.
Weather Mode	Alternate speed measurement mode. The laser only acquires targets that are beyond the range where weather affects the laser's ability to capture a speed reading. Targets must be at a distance greater than 61 meters.
white balance	Compensates for lighting conditions, and allows the camera to "see" white under a given lighting condition.
Zero Velocity Test	See Fixed Distance Test

World Time Zones

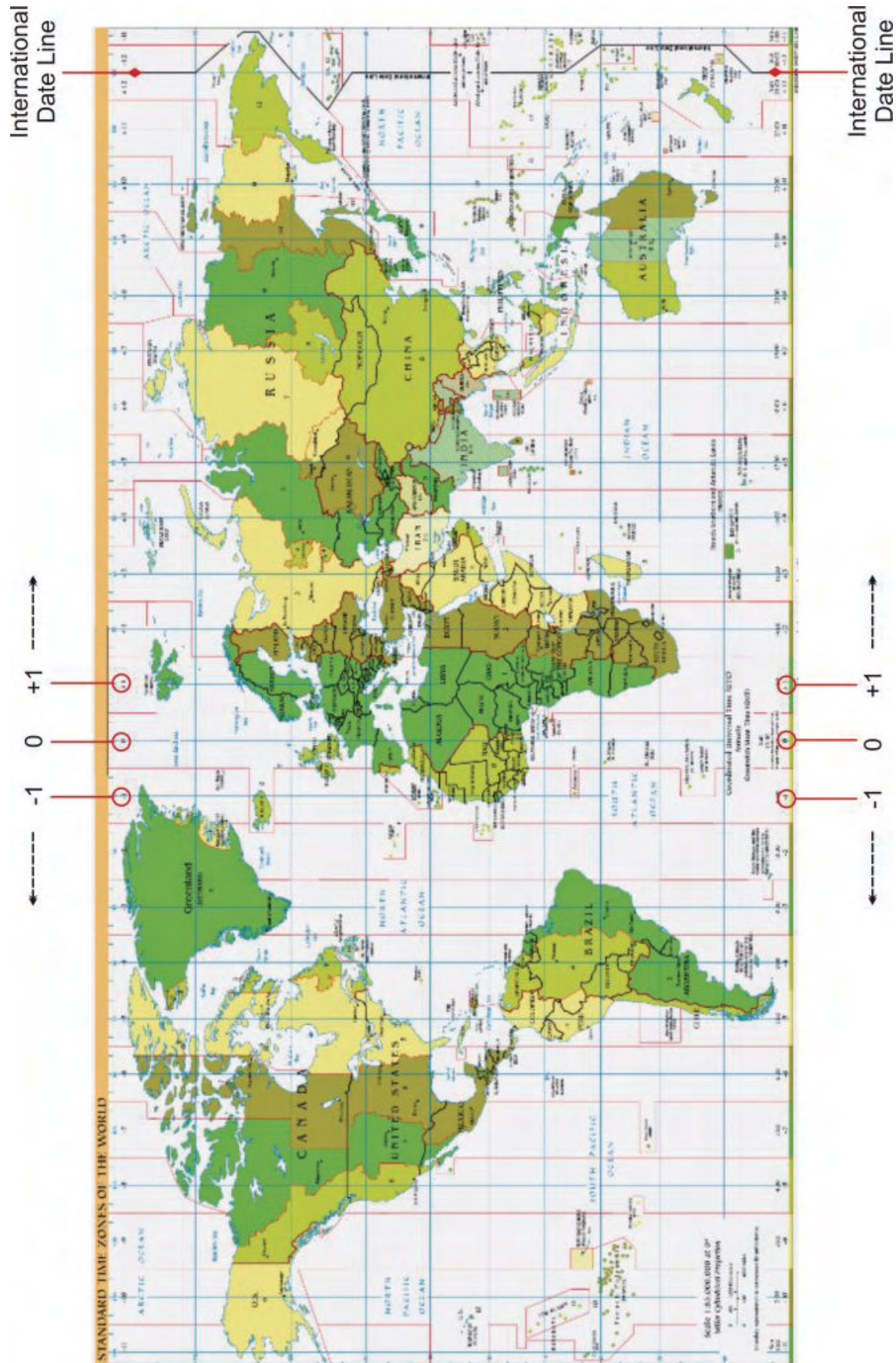


Figure #94

Section #13 - Specifications

Performance

Optimum Focus Distance:	70 meters (230 feet)	
Lens Operating Range:	Hand-held:	15 - 80 meters (50 - 262 feet)
	Tripod mounted:	15 - 90 meters (50 - 295 feet)
Speed Accuracy:	± 2 km/h	
	± 1 mph	
Speed Range	0 km/h to 320 km/h approaching and departing	
	0 mph to 200 mph approaching and departing	
Distance Accuracy:	± 15 cm absolute accuracy	
	± 6 inches absolute accuracy	
Display Resolution:	Speed:	1 km/h
		1 mph
	Distance:	0.1 meter
		1 foot
Minimum Measurement Distance:	Speed Mode:	15.25 meters
		50 feet
	Weather Mode:	61 meters
		200 feet
Maximum Measurement Distance:	1,200 meters	
	4,000 feet	
Measurement Time:	0.33 second	
Maximum Laser Sampling:	up to 3 measurements per second	
Units of Measure: (factory configured)	Speed:	kilometers per hour
		miles per hour
	Distance:	meters
		feet
Laser Power:	90 microwatts nominal	
Laser Wavelength:	905 nanometers nominal	
Beam Divergence:	2.5 milliradians nominal	
Eye Safety:	FDA Class 1 (CFR 21)	
	IEC 60825-1	

Physical Construction

Body:	Composite Polycarbonate outer shell, aluminum internal chassis		
Weight:	1.50 kg (Includes Battery Pack; does not include SD Card.) 3.30 pounds 1.50 kg (Includes Battery Pack; does not include SD Card.)		
Size:	21.0 cm x 9.8 cm x 31.7 cm 8.27 inches x 3.86 inches x 12.47 inches		
Environment:	NEMA 4 / IP55 Water and Dust Resistant		
Temperature Range:	Operating:	-10° C to +60° C (14° F to 140° F)	
	Charging:	0° C to +45° C (32° F to +113° F)	
	Storage:	-20° C to +60° C (-4° F to 140° F)	

Hardware

Processor:	Computer:	AT32AP7000; 147.45 MHz		
	Laser Core:	LPC2136; 40 MHz, 20 PPM		
System Memory:	64 MB SDRAM (73.7 MHz)			
Capture Data Storage:	Removable SD Card:	2 GB and greater		
	SD file system formats:	MS-DOS (FAT16, FAT32) Linux (EXT2, EXT3)		
Display:	2.7 inch (6.9 cm), 240x320 pixel, color, 18 bits per pixel (bpp), touch sensitive			
Camera Sensor:	3.1 MPixel (2048x1536)			
Camera Lens:	75 mm, manual focus and iris			
GPS:	Receiver:	Channels:	20	
		Max Update Rate:	1 Hz	
		Max Altitude:	18,000 meters	(59,000 feet)
		Maximum Velocity:	515 m/sec	(1689 ft/sec)
	Sensitivity:	Acquisition:	-142 dBm	
		Tracking:	-159 dBm	
	Acquisition Times:	Hot Start:	< 1 s	
		Cold Start:	< 35 s	
		Re-acquisition:	< 1.5 s	
	Accuracy:	Horizontal Position:		
		Average:	2.2 meters (7.2 feet)	
		Maximum:	10 meters (32.8 feet), autonomous	
			5 meters (16.4 feet), SBAS corrected	
		Vertical Position:		
		Average:	0 meters	(0 feet)
		Maximum:	15 meters	(49.2 feet)
		Horizontal Velocity:	0.1 m/s (0.3 ft/s)	
	Time Accuracy:	Synchronized with GPS:	1 µs	
Real Time Clock:	CR3032 backup battery:	20 PPM		
		3 years without main battery pack		

Input/Output (I/O)	RS232, serial communications port RS485, night time flash signal USB 2.0, image data transfer Touch panel input 6 button inputs (including TRIGGER)
--------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------

Power

Battery Pack:	7.4 v dc, Lithium-ion Polymer rechargeable battery pack, short circuit and overcharge protected, providing up to 15 hours of cordless operation	
Battery Charger:	Main Charger:	110 v ac to 240 v ac 50/60 Hz input 12 v dc / 1.8 A output (or better)
	Automobile Charger:	11 v dc to 16 v dc, cigarette plug connector with 3 Amp fuse
Power Consumption:	Standby:	950 mW (typical)
	Laser Firing:	2400 mW (typical)

Software

Operating system:	Linux based, with custom device drivers	
Anti-Jam:	Automatic laser jammer avoidance	
Video Size:	Standard Format:	240x180 pixels
	Extended Format:	480x360 pixels
Video Modes:	Selectable video capture frame rate <i>before the measurement</i> and based on motion clip size selection:	
	240x180 (Coarse):	24 fps
		18 fps
		12 fps
	480x360 (Fine):	14 fps
		11 fps
		9 fps
Track Storage:	Selectable frame storage <i>after the measurement</i> and based on the current Frame Rate:	
	<ul style="list-style-type: none"> ● approximately 1/3 of the Frame Rate ● same as the Frame Rate ● approximately 1/6 of the Frame Rate 	
Still Image Sizes:	Selectable:	1920x1440 pixels
		1440x1080 pixels
Maximum Record Size:	120 seconds (2 minutes) or 8 MB which ever occurs first	
Data Encryption:	AES-128	
	United States Federal Information Processing Standards, Advanced Encryption Standard - 128 bit.	

Index

A

accessories 5
AGC. See automatic gain control
aiming reticle 13, 72
 not visible 62
align LCD touch screen 26
aperture 72
Auto Capture 22
Auto Mode 36, 61
automatic gain control (AGC) 30, 72

B

backlight 17
battery
 charger 76
 charging 10
 compartment 7
 icon 12
 release 7
battery pack 7, 76
 inserting or removing 11
 precautions 10
beam divergence 72, 74
beam size crosshair 22, 53
Browse Clips
 TruCAM Image Viewer 53, 55

C

camera
 cover 7, 12
 lens 7, 75
 lens focus distance 22, 31
 power OFF interval 25
 sensor 75
Camera Alignment Test 46
capture speed 19
charging cable 10
charging the battery pack 10
Check & Repair SD Card
 TruCAM Image Viewer 54
classic crosshair 22, 53
cleaning 49
Coordinated Universal Time (UTC) 20
cosine effect 28
 how to minimize 29
crosshair
 TruCAM 22
Crosshair menu
 TruCAM Image Viewer 53

D

dark images 63
data encryption 76
data entry
 keypad 17
date
 format 26
 System Setup Screen 20
date and time
 troubleshooting 61
Delta Distance Test 48, 72
depth of field (DOF) 30
desktop icon
 TruCAM Image Viewer 52
Device Information Screen 24
Device Parameters Screen 25
display
 resolution 74
 specifications 75
distance accuracy 74
Distance between Cars (DBC) Mode 38
Dual Speed Mode 41
dust protection 49

E

error messages 68
 serial data 66
 troubleshooting 61
excess moisture 49
exterior dirt 49
eye safety 6, 74

F

factory default values 51
File menu
 TruCAM Image Viewer 53
film number 24
Fixed Distance Zero Velocity Test 47
focal length 72
focus adjustment ring 12
focus distance
 optimum 74
format parameters
 serial data 65
frame rate 26
front panel 7
fs check 23
F-stop 30, 72
fuzzy images 62

G

GPS
 interval 26
 on-time 61
 receiver 15
 specifications 75

H

HUD Integrity Test 72

I

icon
 battery voltage 12
icons
 list 69
 location 16
input/output 76
installed devices 24
INVALID SD CARD
 error message 63
iris 30, 72
iris adjustment ring 12

J

jam detect 16

K

keypad 17

L

- Language menu
 - TruCAM Image Viewer 54
- language selection
 - System Setup Screen 21
 - TruCAM Image Viewer 60
- laser 72
 - power 74
 - sensors 12
- last alignment check 24
 - troubleshooting 61
- LCD backlight 17
 - power OFF interval 25
- LCD Touch Screen 16
 - caring for 50
 - difficult to see 62
 - realigning 50
- LED charge indicator 7, 61
- license manager 23
- licensed functions 24
- lidar 72
- light images 63
- limited range 62
- line of sight 28
- Linux operating system information 24
- locating *.jmf files on TruCAM 43
- location 19
 - Auto Mode 36
 - DBC Mode 38
 - Speed Mode 28

M

- Manage Locations 53
- Manage Operator Names 53
- Manned Mode 22
 - Auto Mode 36
- maximum record size 76
- measurement
 - Auto Mode 37
 - DBC Mode 40
 - distance 74
 - Dual Speed Mode 42
 - Rear Plate Mode 37
 - Speed Mode 35
 - Weather Mode 36
- measurement units 22
- memory storage 20
- menu bar
 - TruCAM Image Viewer 52, 53
- microcontroller 72
- moisture protection 49
- motion clip Control buttons
 - TruCAM Image Viewer 57
- motion clip sizes 19

O

- Open Clip 53
- opening files
 - TruCAM Image Viewer 55
- operating system 76
- operating temperature 49
- operator ID 19
- operator name 19

P

- password 27
- PC requirements
 - TruCAM Image Viewer 52
- Playback Mode 43
- playing a motion clip
 - TruCAM Image Viewer 57
- power button 7
- power consumption 76
- power OFF intervals 18
- power OFF timer 25
- power supply 10
- powering ON/OFF 18
- precautions 5
- precharging routine
 - battery pack 11
- predefined lists 57
 - locations 59
 - operator names 58
- Predefined Lists menu
 - TruCAM Image Viewer 53
- Print Batch option 54
- Print option 53
- Print Tagged option 53
- Printing menu
 - TruCAM Image Viewer 53

R

- radio frequency interference (RFI) 68
- rain/snow 62
- Real Time Clock (RTC) 75
- rear panel 7
- Rear Plate Mode 37
- receive lens 7, 72
- Refresh Clips Summary 53
- reset settings 27, 50
- roadside location 28
- roadside offset
 - DBC Mode 38

S

- safety. See precautions
- Save Clip
 - compressed 53
 - un-compressed 53
- Save Current Frame 53
- Save Still Image 53
- Scope Alignment Test 45
- screen
 - Device Information 24
 - Device Parameters 25
 - Self Test Results 18
 - System Options 22
 - System Setup 19
 - TruCAM Splash 18
- SD Card 13
 - how to unlock 63
 - slot 7
- SD Tools menu
 - TruCAM Image Viewer 54
- Select TruCAM Languages 54
- Select Viewer Languages 54
- Self Test 18, 45, 72
 - results display 24
- Self Test Results Screen 18
- serial data 65
 - external device commands 66
 - message format 66
 - requests 65
- serial number 24
- serial port 7, 15
- shock protection 49
- shoulder stock release 7
- shutter speed 72
- sighting scope 7, 13
 - caring for 49
- soft keys
 - description 16
- sounds 69
- speaker 7
- specifications 74
- speed accuracy 74
- speed limit 19
- Speed Mode 35
 - how to start 62
- speed range 74
- still image sizes 19, 76
- storage temperature 49
- stylus and holder 7
- system memory 75
- System Options Screen 22
- System Setup Screen 19

I

temperature range 75
time
 System Setup Screen 20
toolbar buttons 16
 list 71
track storage 26, 76
Transfer Clips from SD Card 53
transfer files from SD Card to Office PC
55
transmit lens 7, 72
transporting the TruCAM 49
troubleshooting 61
TruCAM
 languages 60
TruCAM Image Viewer 52
 languages 60
TruCAM Splash Screen 18
TruCAM Version 24
Truck Mode. See Dual Speed Mode
TruCore Version 24

U

unlock SD Card 63
Unmanned Mode 22
 Auto Mode 36
USB port 14
user password 27
 troubleshooting 61
UTC. See Coordinated Universal Time

V

vehicle classification
 Dual Speed Mode 42
version number
 TruCAM 24
 TruCAM Image Viewer 54
 TruCore 24
video mode 19
Video Only Mode 37
video size 76
View Details 53
views
 of the TruCAM 7

W

wavelength 74
Weather Mode 36, 72
white balance 72
world time zones 73
WRITE PROTECTED Unlock SD Card
 error message 63

Z

Zero Velocity Test 72

Notes: